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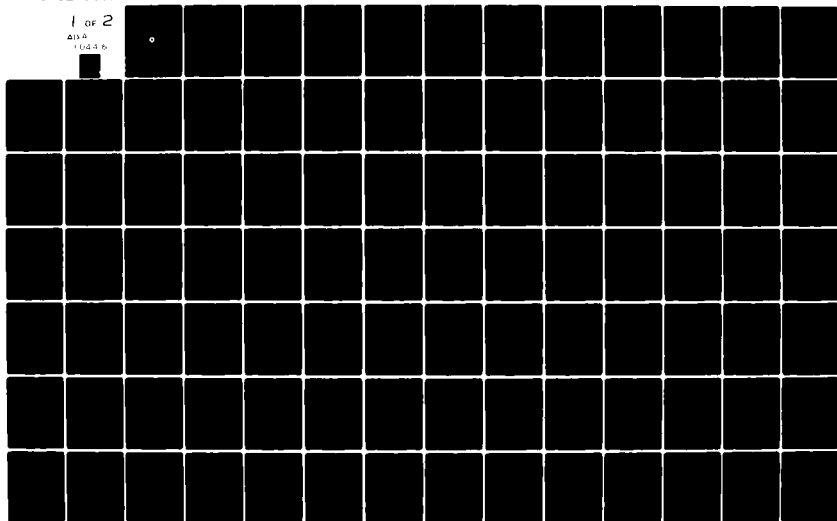
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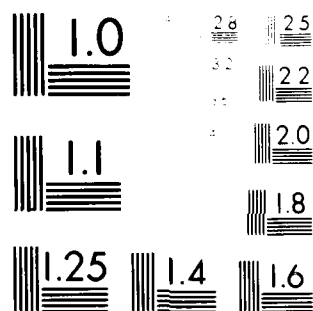
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Report No.

TECHNOLOGY SCENARIO FOR THE YEAR 2005

VOLUME II:

DETAILED SCENES FOR SCENARIOS

by

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FINAL REPORT

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## Technical Report Documentation Page

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<p>16. Abstract: This two-volume study forecasts advances in science and technology and their implications to the Coast Guard to the year 2005. Implications include increasing demands for Coast Guard services, and expanding opportunities for the Coast Guard. Volume I describes the forces acting to promote or inhibit growth of science and technology; identifies potential areas in which the Coast Guard could make use of these advances; and describes a set of four "scenarios" for the year 2005 depicting the potential operational uses of these advances. The central themes of these four scenarios are respectively: command and control, environmental protection, the effects of the impending water shortage in the U.S., and use of an advanced marine vehicle by the Coast Guard. Volume II presents detailed scenes in amplification of the scenarios of Volume I and includes an appendix with a list of references and bibliography. Conclusions:</p> <ul style="list-style-type: none"> <li>o By the year 2005 offshore economic activities will have increased significantly with a concomitant increase in demand for Coast Guard services, particularly service as a law enforcement agency; frequently there will be a requirement for Coast Guard services well beyond 200 miles from the coast.</li> <li>o The increase in demand for Coast Guard service can be met only with a quantum increase in Coast Guard capability--an increase which will be difficult to achieve in any foreseeable budget climate.</li> <li>o U.S. national interest demands that Coast Guard capabilities be devoted to operational rather than regulatory functions, and that the center of gravity of Coast Guard operations be moved seaward, leaving state and local authorities responsible for the closer inshore activities.</li> <li>o The Coast Guard can increase its operational effectiveness in the face of these new demands through exploitation of new technologies in command and control, environmental protection, and advanced marine vehicles.</li> </ul>			
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## PREFACE

This report responds to Coast Guard contract No. DTCG23-80-C-20030 "To develop a series of scenarios representing the technologies for the year 2005 in order that the Coast Guard can evaluate the potential utility and effectiveness of different technologies in a future environment". This study is one of several Coast Guard studies addressing the 25-year future.

The context of the study is the "crunch" in which the Coast Guard is caught between inadequate resources and expanding demand for services.

The scope of the study includes the effects of any technological developments likely to emerge within the latter part of the 20th and early 21st centuries.

Chapters 1 and 2 of Volume I are introductory. Chapter 1 is an introduction and summary; Chapter 2 describes the methodology.

Chapters 3 and 4 of Volume I present an overview forecast of influences operating upon the two domains of principal interest--the Coast Guard on the one hand, science and technology on the other.

Chapters 5 through 9 of Volume I and all four chapters of Volume II present material on the four scenarios: Command and Control, Environmental Protection, Water Shortage, and Advanced Marine Vehicle. As one moves through these chapters the depth of detail increases. Chapter 5 is the most general. Volume II is the most detailed; it provides operational "scenes" for each of the scenarios. Volume II also contains the Appendix, "List of References/Bibliography".

Chapters 10 and 11 of Volume I present the outcome of the study. Chapter 10 presents implications to the Coast Guard, and Chapter 11 sets forth conclusions.

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## CHAPTER 1: THE COMMAND & CONTROL SCENARIO--FOUR SCENES

This chapter depicts an imaginary situation that could arise in the year 2005 should the forecasts described in Chapters 5 and 6 of Volume I come to fruition.

### BACKGROUND

There are four scenes depicted, each centering around a possible "event":

- o Tanker aground in heavy seas
- o Intelligence on smuggling operations from Colombia to Florida
- o Foreign poachers in U.S. fisheries
- o U.S./U.S.S.R. (as proxy for Libya) conflict on nodules 1000 miles out

In each scene the Command Communications Control Center (C<sup>4</sup>) at each of several levels in the command hierarchy are described. At all levels the commander has the option to operate his C<sup>4</sup> console himself or to have an operator do it. The contention is that as the pace of operations increases, and as time intervals between information acquisition and need for decision become extremely short, commanders will feel the need to do their own console operating. Most of the operations will be on-line, but playbacks, situation summaries, and simulations during the actual operations will be possible. One of the features of the advanced centers will be the capability to store sufficient information in a form for immediate feedback as reports of the operations--thereby eliminating or reducing the time required for commanders to file detailed action reports. These playbacks will permit detailed analyses of what occurred in the operation, both by the on-scene commanders and by higher echelons.

Also the commander can enter his intended action into the system, with immediate feedback from the system, as to options which the computer has calculated may be available to carry out this action. These options will be available for such relatively simple actions as "INTEND INTERCEPT TARGET A".

The system will also have the capability to alert the commander to potentially hazardous circumstances by presenting warnings, such as: "WATCH IT: SHOAL AHEAD AT....." or "WATCH INCOMING TRAFFIC AT [location either relative to own forces or geographically]". And the system will offer the commander responses to queries, such as "IF I TAKE COURSE ... AT SPEED...WHAT WILL BE ARRIVAL TIME?" or "WHAT SPEED DO I NEED TO INTERCEPT AT [time]?"

For a commander at any level of command to be fully effective, he must become thoroughly knowledgeable in the capabilities and limitations of the emerging C<sup>4</sup> equipment and the associated concepts. It will be highly beneficial to him to be able to operate consoles himself in order to minimize the time between presentation of information/intelligence and its full appreciation and use. This will imply a change of attitude among many commanders who tend to avoid any manual manipulation, preferring to remain detached and in touch with the "big picture".

Personnel qualified to operate equipment at its full or near-full capability will be scarce. Programming will be set up at different levels--built-in capability, basic software, stations set-up, and action operators. The ability to perform the type programming needed is dependent on an aptitude for "mathematical" reasoning, which might be high at the basic programming level, and somewhat lower as one moves toward the operating level. Nevertheless, sufficiently high mathematical skills will be required even at the operator level so as to render this type personnel scarce. There is an inherent propensity on the part of "operators"--because of the difficulty in learning how to use it effectively--to ignore capabilities of the equipment not frequently used.

Figures 1-1 through 1-4 outline the key elements surrounding each of the scenes contained in our four-part scenario. The text which follows describes in some

detail the circumstances associated with Scene #1, and describes in somewhat less detail the circumstances associated with Scenes #2 through #4. This is because so many of the details of the all the scenes are common. The key operational problem faced in all cases is that of: 1/ Identification of an event needing attention; 2/ Determination of the forces needed on-scene; 3/ Location of the craft needing attention; and 4/ Vectoring own forces to the scene. These common functions are in fact those which the advances in Command Communications and Control (C<sup>3</sup>) technology aids the most. On-scene action by Coast Guard craft is similarly aided by sophisticated C<sup>3</sup>, but frequently the heart of such action involves boarding. This is less susceptible to direct assistance by the new C<sup>3</sup> system; however, it is susceptible to marked improvement over present methods through the use of robots, and this use is included in the scenes. Therefore as Event #1 is described, many more of the technical details of the C<sup>3</sup> system will be explained than are reported in subsequent descriptions.

Each scene is described under the headings:

- o Intelligence & surveillance
- o Target acquisition and identification
- o Target tracking
- o Decision making
- o Commitment of forces and interception
- o On-scene action
- o Follow-up action

Figure 1-1: Key Elements of Scene A

SCENE A: TANKER AGROUND IN HEAVY SEAS	SOURCES	HOW ACQUIRED	HOW DISPLAYED	QUERY OPTIONS	SCENE A: TANKER AGROUND IN HEAVY SEAS
o NAME & REGT OF SHIP	NIN*, TDN*	ANY OF DATA/INTELLIGENCE	CRT, VIDEOCON-	WHAT IF I...	ANY OF MEANS OF DISPLAY LISTED IN PREVIOUS COLUMN;
o CONDITION & LOCATION OF SHIP--GEOGRAPHIC & REL TO OWN FORCES	LOCAL NON-AUTOMATED MEANS--VISUAL, OWN ACOUSTIC, ELECTROMAGNETIC, LASER, IR PASSIVE, OR ACTIVE DEVICES	ACQUISITION SOURCES IDENTIFIED IN PREV. SECTIONS OF THIS SCENARIO.	FERENCES, TELECONFERENCES, DIGITAL DIALS, HISTOGRAMS, STAT DIST., ANALOGUE PRESENTATION, PICTORIAL, MAP/CHART	WHAT IF HE...? WHAT IS PROBABILITY THAT...? FACT QUESTION IN ADDITION CAN MY OBJECTIVE IS TO...; WHAT IS BEST WAY TO ACHIEVE...? WHAT IS HIGH COMMAND POLICY	ANY OF MEANS OF DISPLAY LISTED IN PREVIOUS COLUMN;
o CHART: SHIP & OWN FORCES	IC, LASER, IR PASSIVE, OR ACTIVE DEVICES	ANY CDR's DECISION: TO ADMIT DATA FROM OTHER DS THAN ONE HE COMMANDS; CAN DO SO BY "OPENING THE GATES", OR BY SELECTIVE ADMITTANCE.	STAT DIST., ANALOGUE PRESENTATION, PICTORIAL, MAP/CHART	MY OBJECTIVE IS TO...; WHAT IS BEST WAY TO ACHIEVE...? WHAT IS HIGH COMMAND POLICY	ANY OF MEANS OF DISPLAY LISTED IN PREVIOUS COLUMN;
o DEPLOYMENT OF OWN & OTHER FORCES	SWITCHING BETWEEN NETS ALSO DONE THROUGH INFO SWITCHING EXCHANGE (ISX) COMPUTER, OPERABLE FRM EACH STATION TO GIVE CDR OPTIONS AS TO SOURCES	DATA FROM OTHER DS THAN ONE HE COMMANDS; CAN DO SO BY "OPENING THE GATES", OR BY SELECTIVE ADMITTANCE.	FERENCES, TELECONFERENCES, DIGITAL DIALS, HISTOGRAMS, STAT DIST., ANALOGUE PRESENTATION, PICTORIAL, MAP/CHART	WHAT IF HE...? WHAT IS PROBABILITY THAT...? FACT QUESTION IN ADDITION CAN MY OBJECTIVE IS TO...; WHAT IS BEST WAY TO ACHIEVE...? WHAT IS HIGH COMMAND POLICY	ANY OF MEANS OF DISPLAY LISTED IN PREVIOUS COLUMN;
o ORIGIN AND DESTINATION OF SHIP	TO IDENTIFY SHIP AND OWN FORCES	ANY CDR's DECISION: TO ADMIT DATA FROM OTHER DS THAN ONE HE COMMANDS; CAN DO SO BY "OPENING THE GATES", OR BY SELECTIVE ADMITTANCE.	STAT DIST., ANALOGUE PRESENTATION, PICTORIAL, MAP/CHART	MY OBJECTIVE IS TO...; WHAT IS BEST WAY TO ACHIEVE...? WHAT IS HIGH COMMAND POLICY	ANY OF MEANS OF DISPLAY LISTED IN PREVIOUS COLUMN;
o INTELLIGENCE ON SHIP, CARGO, CREW, ETC.	SWITCHING BETWEEN NETS ALSO DONE THROUGH INFO SWITCHING EXCHANGE (ISX) COMPUTER, OPERABLE FRM EACH STATION TO GIVE CDR OPTIONS AS TO SOURCES	DATA FROM OTHER DS THAN ONE HE COMMANDS; CAN DO SO BY "OPENING THE GATES", OR BY SELECTIVE ADMITTANCE.	FERENCES, TELECONFERENCES, DIGITAL DIALS, HISTOGRAMS, STAT DIST., ANALOGUE PRESENTATION, PICTORIAL, MAP/CHART	MY OBJECTIVE IS TO...; WHAT IS BEST WAY TO ACHIEVE...? WHAT IS HIGH COMMAND POLICY	ANY OF MEANS OF DISPLAY LISTED IN PREVIOUS COLUMN;
o SHIP CHARACTERISTICS SIZE, SPEED, ETC.	TO IDENTIFY SHIP AND OWN FORCES	ANY CDR's DECISION: TO ADMIT DATA FROM OTHER DS THAN ONE HE COMMANDS; CAN DO SO BY "OPENING THE GATES", OR BY SELECTIVE ADMITTANCE.	STAT DIST., ANALOGUE PRESENTATION, PICTORIAL, MAP/CHART	MY OBJECTIVE IS TO...; WHAT IS BEST WAY TO ACHIEVE...? WHAT IS HIGH COMMAND POLICY	ANY OF MEANS OF DISPLAY LISTED IN PREVIOUS COLUMN;
o SCREEN SHOWING PLAN OF SCENE WITH TAGS	SWITCHING BETWEEN NETS ALSO DONE THROUGH INFO SWITCHING EXCHANGE (ISX) COMPUTER, OPERABLE FRM EACH STATION TO GIVE CDR OPTIONS AS TO SOURCES	DATA FROM OTHER DS THAN ONE HE COMMANDS; CAN DO SO BY "OPENING THE GATES", OR BY SELECTIVE ADMITTANCE.	STAT DIST., ANALOGUE PRESENTATION, PICTORIAL, MAP/CHART	MY OBJECTIVE IS TO...; WHAT IS BEST WAY TO ACHIEVE...? WHAT IS HIGH COMMAND POLICY	ANY OF MEANS OF DISPLAY LISTED IN PREVIOUS COLUMN;
o TO IDENTIFY SHIP AND OWN FORCES	SWITCHING BETWEEN NETS ALSO DONE THROUGH INFO SWITCHING EXCHANGE (ISX) COMPUTER, OPERABLE FRM EACH STATION TO GIVE CDR OPTIONS AS TO SOURCES	DATA FROM OTHER DS THAN ONE HE COMMANDS; CAN DO SO BY "OPENING THE GATES", OR BY SELECTIVE ADMITTANCE.	STAT DIST., ANALOGUE PRESENTATION, PICTORIAL, MAP/CHART	MY OBJECTIVE IS TO...; WHAT IS BEST WAY TO ACHIEVE...? WHAT IS HIGH COMMAND POLICY	ANY OF MEANS OF DISPLAY LISTED IN PREVIOUS COLUMN;
o SAFETY ESTIMATE -- PROBABILITY OF FOUNDERING IN "X" HOURS/DAYS?	TO IDENTIFY SHIP AND OWN FORCES	ANY CDR's DECISION: TO ADMIT DATA FROM OTHER DS THAN ONE HE COMMANDS; CAN DO SO BY "OPENING THE GATES", OR BY SELECTIVE ADMITTANCE.	STAT DIST., ANALOGUE PRESENTATION, PICTORIAL, MAP/CHART	MY OBJECTIVE IS TO...; WHAT IS BEST WAY TO ACHIEVE...? WHAT IS HIGH COMMAND POLICY	ANY OF MEANS OF DISPLAY LISTED IN PREVIOUS COLUMN;
o "UPDATE" COMMAND OPERATION--FOR AUTOMATIC TRANSMISSION IF NEG. WITH CDR'S INTENT	SWITCHING BETWEEN NETS ALSO DONE THROUGH INFO SWITCHING EXCHANGE (ISX) COMPUTER, OPERABLE FRM EACH STATION TO GIVE CDR OPTIONS AS TO SOURCES	DATA FROM OTHER DS THAN ONE HE COMMANDS; CAN DO SO BY "OPENING THE GATES", OR BY SELECTIVE ADMITTANCE.	STAT DIST., ANALOGUE PRESENTATION, PICTORIAL, MAP/CHART	MY OBJECTIVE IS TO...; WHAT IS BEST WAY TO ACHIEVE...? WHAT IS HIGH COMMAND POLICY	ANY OF MEANS OF DISPLAY LISTED IN PREVIOUS COLUMN;
o QUERY CAPABILITY TO IDENTIFY OTHER ITEMS BEING DISPLAYED	TO IDENTIFY SHIP AND OWN FORCES	ANY CDR's DECISION: TO ADMIT DATA FROM OTHER DS THAN ONE HE COMMANDS; CAN DO SO BY "OPENING THE GATES", OR BY SELECTIVE ADMITTANCE.	STAT DIST., ANALOGUE PRESENTATION, PICTORIAL, MAP/CHART	MY OBJECTIVE IS TO...; WHAT IS BEST WAY TO ACHIEVE...? WHAT IS HIGH COMMAND POLICY	ANY OF MEANS OF DISPLAY LISTED IN PREVIOUS COLUMN;
o SEA ZONES--CORRIDORS, ACCESS REGIONS, SEP. SCHEMES, TRAFFIC LA.'S	SWITCHING BETWEEN NETS ALSO DONE THROUGH INFO SWITCHING EXCHANGE (ISX) COMPUTER, OPERABLE FRM EACH STATION TO GIVE CDR OPTIONS AS TO SOURCES	DATA FROM OTHER DS THAN ONE HE COMMANDS; CAN DO SO BY "OPENING THE GATES", OR BY SELECTIVE ADMITTANCE.	STAT DIST., ANALOGUE PRESENTATION, PICTORIAL, MAP/CHART	MY OBJECTIVE IS TO...; WHAT IS BEST WAY TO ACHIEVE...? WHAT IS HIGH COMMAND POLICY	ANY OF MEANS OF DISPLAY LISTED IN PREVIOUS COLUMN;

\*NIN = National Intelligence Net; 3; where: 1 means the overall Central Intelligence national intelligence network; 2 means the DOD intelligence network; and 3 means the CG intelligence network.  
 TDN = CG Tactical Data Net; 4; 1 = a CG wide data net; 2 = regional net; 3 = district net; 4 = on-scene net



Figure 1-2: Key Elements of Scene B

SCENE B: SMUGGLING OPERATIONS	SOURCES	HOW ACQUIRED	HOW DISPLAYED	QUERY OPTIONS	DISPLAY OPTIONS
o BEST ESTIMATE OF ROUTING	NIN*, TDN*	ANY OF DATA/INTELLIGENCE ACQUISITION	CRT, VIDEOCONFERENCES, TELECONFERENCES, DIGITAL DIALS, HISTOGRAMS, STAT DIST., ANALOGUE PRESENTATION, PICTORIAL, MAP/CHART	WHAT IF I... WHAT IF HE...? WHAT IS PROBABILITY THAT...? FACT QUESTION MY OBJECTIVE IS TO...; WHAT IS BEST WAY TO ACHIEVE...? WHAT IS HIGH COMMAND POLICY ON...? IF BEST WAY TO DO IT DOES NOT WORK, WHAT IS NEXT BEST...? IF ... IS... INSTEAD OF ... WHAT IS BEST WAY THEN...? PLEASE GET PERMISSION FOR ME TO USE FORCE... WHAT NAVAL FORCES MAY I COUNT ON...?	CAPABILITY TO USE ANY OF MEANS OF DISPLAY LISTED IN PREVIOUS COLUMN; IN ADDITION CAN CALL FOR DISPLAY OF ANY INFO/INTEL FROM ANY OTHER COMMAND, OR FROM ANY UNIT IN OWN COMMAND -- I.F. A UNIT HEAVILY OCCUPIED IN ACTION AND NOT IN A POSITION TO REPORT THE SITUATION.
o LOCATION OF SHIPS RELATIVE TO OWN SHIPS	LOCAL NON-AUTOMATED	SOURCES IDENTIFIED IN PREV. SECTIONS OF THIS SCENARIO.			
o CHART SHOWING TARGET SHIPS AND OWN FORCES	MEANS--VISUAL, OWN ACOUSTIC, ELECTROMAGNETIC, LASER, IR				
o INTELLIGENCE ON CARGO & SHIP TYPES	PASSIVE, OR ACTIVE DEVICES	ANY CDR's DECISION: TO ADMIT DATA FROM OTHER DS THAN ONE HE COMMANDS; CAN DO SO BY "OPENING THE GATES", OR BY SELECTIVE ADMITTANCE.	FLASHING LTS, HOLOGRAPHIC DISPLAYS		
o SHIP CHARACTERISTICS--SPEEDS, SIZE, ARMAMENT	SWITCHING BETWEEN NETS				
o WEATHER CONDITIONS	ALSO DONE THROUGH INFO SWITCHING				
o ALONG ESTIMATED ROUTES	EXCHANGE (ISX) COMPUTER, OPERABLE FROM EACH STATION				
o CONTINUING UPDATES AS TO TIME TO INTERCEPT, OPTIMUM DEPLOYMENT TO INTERCEPT MAXIMUM NUMBER OF MOST VALUABLE SHIPS	OPTIONS AS TO SOURCES				
o CRT SCREEN DISPLAY SHOWING PLAN OF SCENE WITH TAGS TO IDENTIFY TARGET CRAFT & OWN FORCES	HEAVY DEPENDENCE ON THE NIN's, ESPECIALLY THE LAW ENFORCEMENT NETS				
o "UPDATE" COMMAND OPTIONS--WITH AUTOMATIC TRANSMISSION CAPABILITY	LAW ENFORCEMENT NETS				
o QUERY CAPABILITY TO IDENTIFY OTHER ITEMS BEING DISPLAYED					
o SEA ZONES, CORRIDORS, ACCESS REGIONS, SEPARATION SCHEMES, TRAFFIC LANES					

List of abbreviations (cont'd from figure 1-1)

HUMINT - human-collected intelligence  
INTEL EST - intelligence estimate  
CHAR - characteristics  
OP - operating/operational  
NEC - necessity/necessary  
SC - scene  
CDR - commander

\*NIN = National Intelligence Net 1-3; where 1 means the overall Central Intelligence national intelligence network, 2 means the DOD intelligence network, and 3 means the CG intelligence network.

TDN = CG Tactical Data Net 1-4; 1 = a CG wide data net; 2 = regional net; 3 = district net; 4 = on-scene net

Figure 1-3: Key Elements of Scene C

SCENE C: POACHERS IN U.S. FISHING GROUNDS	SOURCES	HOW ACQUIRED	HOW DISPLAYED	QUERY OPTIONS	DISPLAY OPTIONS
o IDENTITY AND LOCATIONS OF POACHING CRAFT	NIN <sub>n</sub> *, TDN <sub>m</sub> *	ANY OF DATA/INTELLIGENCE	CRT, VIDEOCONFERENCES, TELECONFERENCES,	WHAT IF I...	ANY OF MEANS OF DISPLAY LISTED IN
o INTEL. EST.: INTENT OF PARENT GOVERNMENT	LOCAL NON-AUTOMATED	ACQUISITION	DIGITAL DIALS, HISTOGRAMS,	WHAT IF HE...?	PREVIOUS COLUMN;
o CHAR. OF OFFENDING OP.	MEANS--VISUAL, OWN ACOUSTIC,	SOURCES IDENTIFIED IN PREV. SECTIONS OF THIS SCENARIO.	STAT DIST., ANALOGUE PRESENTATION,	BILITY THAT...?	IN ADDITION CAN
o HISTORY OF PAST INCIDENTS WITH THIS NATION	ELECTROMAGNETIC, LASER, IR		PICTORIAL, MAP/CHART	MY OBJECTIVE IS TO...; WHAT IS BEST WAY TO	CALL FOR DISPLAY OF ANY INFO/INTEL FROM ANY OTHER
o WEATHER--LOCAL AND AT SCENE	PASSIVE, OR ACTIVE DEVICES	ANY CDR's DECISION: TO ADMIT DATA FROM OTHER DS THAN ONE HE COMMANDS; CAN DO SO BY "OPENING THE GATES", OR BY SELECTIVE ADMITTANCE.	FLASHING LTS, HOLOGRAPHIC DISPLAYS	ACHIEVE...?	COMMAND, OR FROM ANY UNIT IN OWN COMMAND -- I.E.
o U.S. FISH. CRAFT INVOLVED	SWITCHING BETWEEN NETS ALSO DONE THROUGH INFO SWITCHING EXCHANGE (ISX)			WHAT IS HIGH COMMAND POLICY	A UNIT HEAVILY OCCUPIED IN ACTION AND NOT IN A POSITION TO REPORT THE SITUATION.
o DEPLOY: OWN FORCES RELATIVE TO POACHERS AND OTHERS	COMPUTER, OPERABLE FROM EACH STATION TO GIVE CDR OPTIONS AS TO SOURCES			ON...? IF BEST WAY TO DO IT DOES NOT WORK, WHAT IS NEXT BEST...? IF .... IS... INSTEAD OF ...., WHAT IS BEST WAY THEN....?	
o EST. INTENT POACHERS LANGUAGE IN USE					
o CHARACTERISTICS OF FOREIGN CRAFT--I.E. SPEED, ENDURANCE, ARMAMENT					
o SEA ZONES, CORRIDORS, ACCESS REGIONS, SEPS, SCHEMES, TRAFFIC LANES					
o SCREEN SHOWING PLAN OF SCENE WITH TAGS TO IDENTIFY SHIP AND OWN FORCES					
o QUERY CAPABILITY TO IDENTIFY OTHER ITEMS BEING DISPLAYED					
o "UPDATE" COMMAND					
o OPTION: FOR AUTOMATIC TRANS.: OF NEC WITH CDR INTENT					

\*VIN<sub>n</sub> = National Intelligence Net<sub>1-3</sub>; where 1 means the overall Central Intelligence national intelligence network, 2 means the DOD intelligence network, and 3 means the CG intelligence network.  
 TDN<sub>m</sub> = CG Tactical Data Net<sub>1-4</sub>; 1 = a CG wide data net; 2 = regional net; 3 = district net; 4 = on-scene net

Figure 1-4: Key Elements in Scene D

SCENE D: U.S./U.S.S.R. CONFLICT OVER NODULES	SOURCES	HOW ACQUIRED	HOW DISPLAYED	QUERY OPTIONS	DISPLAY OPTIONS
o U.S.S.R. FORCES ON SCENE	NIN <sub>n</sub> *, TDN <sub>m</sub> *	ANY OF DATA/INTELLIGENCE ACQUISITION	CRT, VIDEOCONFERENCES, TELEFERENCES, DIGITAL DIALS, HISTOGRAMS, STAT DIST., ANALOGUE PRESENTATION, PICTORIAL, MAP/CHART	WHAT IF I... WHAT IF HE...? WHAT IS PROBABILITY THAT...? FACT QUESTION MY OBJECTIVE IS TO...; WHAT IS BEST WAY TO ACHIEVE...?	ANY OF MEANS OF DISPLAY LISTED IN PREVIOUS COLUMN; IN ADDITION CAN CALL FOR DISPLAY OF ANY INFO/INTEL FROM ANY OTHER COMMAND, OR FROM ANY UNIT IN OWN COMMAND -- I.E. A UNIT HEAVILY OCCUPIED IN ACTION AND NOT IN A POSITION TO REPORT THE SITUATION.
o NATURE OF U.S.S.R. ACTION	LOCAL NON-AUTOMATED	SOURCES IDENTIFIED IN PREV. SECTIONS OF THIS SCENARIO.	ANY CDR's DECISION: TO ADMIT DATA FROM OTHER DS THAN ONE HE COMMANDS; CAN DO SO BY "OPENING THE GATES", OR BY SELECTIVE ADMITTANCE.	WHAT IS HIGH COMMAND POLICY ON...? IF BEST WAY TO DO IT DOES NOT WORK, WHAT IS NEXT BEST...? IF .... IS... INSTEAD OF ...., WHAT IS BEST WAY THEN...?	
o CHART SHOWING FOREIGN SHIPS AND OWN FORCE DEPLOYMENT	MEANS--VISUAL, OWN ACOUSTIC, ELECTROMAGNETIC, LASER, IR PASSIVE, OR ACTIVE DEVICES	ANY CDR's DECISION: TO ADMIT DATA FROM OTHER DS THAN ONE HE COMMANDS; CAN DO SO BY "OPENING THE GATES", OR BY SELECTIVE ADMITTANCE.	FLASHING LTS, HOLOGRAPHIC DISPLAYS	INTERNATIONAL IMPORTANCE OF SITUATION LIKELY TO RENDER OPERATION SUBJECT TO CLOSE CONTROL OF HIGHER COMMAND LEVELS	
o INTELLIGENCE ESTIMATES OF U.S.S.R. INTENTIONS	SWITCHING BETWEEN NETS	DO SO BY "OPENING THE GATES", OR BY SELECTIVE ADMITTANCE.			
o STATUS OF U.S. MINING OPERATIONS IN AREA	ALSO DONE THROUGH INFO SWITCHING EXCHANGE (ISX) COMPUTER, OPERABLE FRM EACH STATION TO GIVE CDR OPTIONS AS TO SOURCES	VOICE RADIO OR VIDEOCONFERENCE LIKELY TO BE IMPORTANT AS MEANS OF ACQUIRING INFO			
o INTELLIGENCE ON SHIP, CARGO, CREW, SHIP CHARACTERISTICS -- SIZE, SPEED, CAPACITY, TYPE, ETC. WEATHER -- PRESENT AND FORECAST	NIN <sub>1</sub> WILL BE A MAJOR SOURCE	WHITE HOUSE INPUTS MAY BE EXPECTED TO CONSTITUTE A MAJOR SHARE OF SOURCE DIRECTION			
o LATEST POLICY ISSUANCE	WHITE HOUSE				
o SAFETY ESTIMATE -- PROBABILITY OF FOUNDERING IN "X" HOURS/DAYS?	INPUTS MAY BE EXPECTED TO CONSTITUTE A MAJOR SHARE OF SOURCE DIRECTION				
o SCREEN SHOWING PLAN OF SCENE WITH TAGS TO IDENTIFY FOREIGN SHIPS & OWN FORCES	QUERY CAPABILITY TO IDENTIFY OTHER ITEMS BEING DISPLAYED				
o "UPDATE" COMMAND OPTION: AS IN PREVIOUS SCENES	AS IN PREVIOUS SCENES				
o ZONES: AS IN PREV SC.	ZONES: AS IN PREV SC.				

\*NIN<sub>n</sub> = National Intelligence Net<sub>1-3</sub>; where 1 means the overall Central Intelligence national intelligence network, 2 means the DOD intelligence network, and 3 means the CG intelligence network.  
 TDN<sub>m</sub> = CG Tactical Data Net<sub>1-4</sub>; 1 = a CG wide data net; 2 = regional net; 3 = district net; 4 = on-scene net

## SCENE A: TANKER AGROUND IN HEAVY SEAS

The situation: The Commandant and all subordinate commanders are at their respective desks or at home asleep. Tanker TUO (Tanker of Unknown Origin) goes aground in the Florida Straits and sends out an SOS message.

### Intelligence and surveillance system in operation

Three National Intelligence Networks are in operation. The first, and senior, is that operated by the central intelligence system, and fed into by all the the federal government agencies with intelligence interests, including the defense department on an unclassified basis. The second net is operated by the defense department and is largely classified information not available to the unclassified nets. Certain channels of this net are integrated with the other national nets to provide assistance on a not-to-interfere-with-security basis. The third net is the CG intelligence net. Advances in communications and surveillance technology have made such a net not only feasible, but almost essential for the CG to maintain up-to-date information on fast moving situations.

These three nets are operated independently but tied together to permit relatively free flow of information among them. Any authority in one may query any of the others. The Coast Guard net (NIN<sub>3</sub>), the least sophisticated of the three, depends heavily on the other two. Because of the increases in law enforcement activities in the federal government--DEA, FBI, as well as the CG--the Coast Guard has become one of the principal clients of the NIN<sub>1</sub>.

CRTs at time of grounding were showing locations and identities of a large number of other ships up and down the coast. Should any of these others have grounded, the system would have labeled the name, port of origin, destination, cargo, and crew immediately upon receipt of the grounding signal. But in the case of TUO, the ship had not been in the established reporting system

(the successor or next generation American Merchant Vessel Emergency Reporting System, known currently as AMVERS). Therefore information on these details was absent--a point suspicious enough in itself to warrant further checking at the slightest hint of irregular behavior.

#### Target Acquisition and Identification

The NIN<sub>3</sub> receives the SOS signal and queries its data bank for information on the ship. The AMVERS-equivalent system has no information on any ship in the exact location of the TUO, and the query result is negative. Immediately and automatically the NIN<sub>3</sub> queries the higher level NINs (NIN<sub>1</sub> and NIN<sub>2</sub>) for information about the ship. The satellite-based national surveillance system, part of the general NIN, picks up the TUO from its sensors, but no other information is available in the NINs. It is located automatically simply through triangulation of its incoming radio signal. This is augmented by satellite-borne radar.

#### Target Tracking

CG C<sup>4</sup>s at all levels pick up the message and alerts sound in both the centers and in the working and living areas of the operating personnel. The regional target designation net (TDN<sub>2</sub>) is fed the pertinent information from the NIN, and shows this information on the CRT screens in all C<sup>4</sup>'s of stations and operating patrol craft--air and surface in the region. The TDNs and their CRT screens, tied in to the national surveillance system, pick up the stranded tanker.

#### Decision Making

The CG local commander (CGLC) proceeds to his C<sup>4</sup> and updates himself on the situation. All CG commanders (CGCs) in the chain of command check screens to ascertain deployment of own forces, query the system to ascertain vessels most able to take the twofold mission--first rescue of personnel and protection

of equipment, and second prevention of environmental damage.

The CGLC with cognizance is the commanding officer of a high endurance cutter based on the U.S. coast, and is already identified on the screen of each C<sup>4</sup> simply from the geographical location of the TUO. He checks his own screen and identifies ships available to him for a rescue mission. He also identifies the location of aircraft that could be made available if the situation warrants. He alerts his ship's company to the impending mission, indicates to his immediate senior "PREPARING TO ASSIST TUO; UNLESS OTHERWISE DIRECTED, WILL DEPART IN xx MINUTES." The CGLC's immediate superior inputs an "OK" into the TDN, which automatically gets to the CGLC. The usual practice will continue to be for the commanders at the different levels to hold discussions on the situation and come to mutual understanding and agreement before the decision is made; however, should this not be necessary, or should any level of command prefer to operate with minimum discussion, the sequence as described could occur. District, regional, and national command centers show this action on their respective screens with no oral messages having been necessary to this point.

Commanders at all levels query NIN<sub>1</sub> to ascertain port of origin and other other information on TUO, particularly information as to possible illegal activities, crew composition, cargo, communications equipment in use and frequencies guarded, and likely environmental effects from damage to ship's hull. This information appears in print-out at each station queried, with options to query further if needed.

Radio frequencies guarded by TUO are ascertained and CGLC attempts unsuccessfully to communicate with master. Query to TDN<sub>3</sub> indicates weather in vicinity of TUO is high wind (sustained at approximately 40 knots, gusts to 70), heavy seas and heavy rain with temperatures in low fifties, tidal range virtually zero, current NE at four knots, visibility unknown but probably low.

Query on "State of own forces" indicates 3 cutters assigned, with cutters "R" "S" and "T" on one hour notice. Two helos at air station "A" are indicated by the air commander as being available on one-half-hour notice. All ships assigned fueled to 100%, and the only down equipment is in cutter "R". "R" is restricted in speed to 90% of rated speed.

#### Commitment of Forces to Interception

CGLC decision: assemble two cutters "S" and "T", leaving "R" and two helos in stand-by. This decision is transmitted to own forces through TDN<sub>4</sub>, with a simple command addressed to units selected, "TAKE APPROPRIATE ACTION ON TUO". The decision is automatically transmitted to higher commands for their information through other TDNs. Thus all commands know immediately the intentions and the state of progress of the CGLC. Should these other levels of command be engaged in other concerns while the foregoing takes place--all in a matter of about 1-2 minutes--they need not be monitoring the activity, but merely be aware that upon query for "SITUATION OF TUO?" their respective C<sup>4</sup>'s will provide a full update. Should any of these higher commands feel the need to insure that the CGLC is aware of some particular feature of the situation, he can simply call the CGLC or an intermediate command and ask, or he can underscore the information in his own TDN, and signal "BE SURE YOU TAKE .....INTO ACCOUNT" to the CGLC and all intermediate commands. Voice communications between all levels is always an available options.

The CGLC's C<sup>3</sup> equipment permits rapid and thorough search of frequency bands to find any possible frequencies in use by TUO. Direction finding capability in the two cutters plus associated shore stations permits triangulation and geographical confirmation of the ship's location/identity. Any of several stations using the TDN can search and query with automatic coordination with the others, provided the fact that all are in this particular search mode is

entered into the system. The command into the system, "FIND RADIO TRANSMISSIONS FROM LAT.....LONG..... AND IDENTIFY FREQUENCIES" will start the automated search.

Once one channel of communications with TUO is established, it will be relatively easy to establish all that are needed for the rescue, law enforcement, and/or environmental protection operations--as the case may be.

From this point on, until joining of CG forces with TUO at the scene, automatic inputs into the CGLC TDN will load the system with sufficient information that higher levels of command can query the system and ascertain progress toward the interception without voice communications with the CGLC or the cutters proceeding to the scene. (The CGLC may be embarked in one of these cutters or he may be stationed ashore.)

If voice communications with TUO are established--and they may not be for a number of reasons, including language barriers--the CGLC can ascertain details of the ship's condition as his force proceeds to the scene. As weather permits, he can proceed with the rescue or other operations as appropriate, inserting into his TDN information for use by higher levels and other TDNs.

By the time this has occurred, the search of the intelligence nets will have revealed information as to the background of the TUO, which will have been provided automatically to the CGLC. It is highly unlikely that no data on the TUO will be available; should this be the case, it is likely that either a law enforcement problem confronts the CGLC or that a foreign nation is involved in a possible hostile act. At this point, the active interest of higher levels of command will be determined by the legitimacy of the TUO's presence in the waters. Should the higher level of interest prevail, then a simple command to each system "OPEN GATES TO ALL INFO ON TUO" will load the respective TDNs--and if appropriate the NINs--with information as it develops.



As the rescue force approaches the TUO, navigation charts entered into the commander's TDN provide him with CRT displays of his own and TUO positions with respect to geographic characteristics, and provide each commanding officer with warnings when approaching shoal waters. These warnings can be programmed in by each commanding officer depending upon his own preferences. Some commanding officers will welcome them as backstops to their own navigation; others will prefer to do more navigation manually, with fear of excessive reliance upon automated systems for the safety of their ships.

Also during transit to the TUO, the ships of the force may encounter other traffic. As the need to conform to the rules of the road and maintain safe transit dictates, the cutters' TDNs may compute safe distances, closest points of approach, and courses and speeds to accomplish these ends. These will be revealed to the respective conning officers, and at their options the craft will take the computed courses and speeds. In any case, the computations will be useful as backstops to the manual calculations of the conning officers.

#### On-Scene Action

The CGLC's force will include robots, EM, laser, photographic, chemical, IR, acoustic, and visual equipment with which to determine the characteristics of ship, cargo, crew, and state of damage being incurred--both to ship and to environment.

At the scene the CGLC sends his robot to the TUO for reconnaissance. The robot is equipped with television and radio, and therefore transmits back to the CGLC, and to all other commands plugged into the net, the essential information on the condition of the TUO. The CGLC's control of the robot permits him to use it to remove injured personnel from TUO despite heavy seas and high winds. (It also permits safe "boarding" of the craft by Coast Guard observers who remain safely in their own craft while observing, through television in the

robot, the activities in the target ship, whether the target is ship in distress, law violator, or other. The robot also assists in the safe removal of personnel from the target ship.)

#### A Variation on this Scene

The foregoing has been a somewhat simple scenario. To complicate it, imagine a scenario in which there are two groundings concurrently with limited Coast Guard resources for response. At the level of common command of both potential sets of forces the TDN will enable the commander to calculate the optimum force allocation to insure maximum probability of aiding both ships in distress. As the data/information on both ships in distress goes into the TDNs, the system will be able to respond to queries such as, "NEED TWO CUTTERS OR ONE CUTTER AND ONE HELO AT EACH SCENE; [GIVEN THE LOCATIONS OF DISTRESSED CRAFT AND THE LOCATIONS AND CAPABILITIES OF OWN CRAFT] WHAT COMBINATION OF OWN FORCES SHOULD BE SENT FROM EACH OF THREE LOCATIONS OF OWN FORCES IN ORDER TO MAXIMIZE PROBABILITY OF SUCCESSFUL ASSISTANCE?" The CGLCs will not follow the answers blindly, but will use the answers as guides to action; these guides will be considered reliable to the extent that information provided to the systems is adequate.

#### A Second Variation

A third stage of complexity would be a fairly large number of fishing and/or recreational craft in trouble from a sudden violent storm over a 100,000 square mile area. Some unknown number of the craft have transponders which permit ready identification and location; another unknown number have emergency SOS transmitters; another unknown number of craft are in the general vicinity.

The CG forces consist of:

w	midrange search aircraft	r	helos
x	high endurance cutters	s	LTA
y	medium endurance cutters	t	SES
z	patrol boats		

These CG forces are stationed over about 300 miles of U.S. coast line at CG bases and air stations; each has at least one robot on board with which to board other craft and remove personnel and/or equipment.

The problem is how to develop a plan of rescue/aid that maximizes effectiveness and efficiency in the allocation of CG resources. Although a prioritization problem of this magnitude is unlikely to occur very often, it would constitute a major problem when it did occur. On the other hand, with Coast Guard resources diminishing, and with the offshore activities increasing even more rapidly, the overload represented by this scenario is highly likely to occur in the not too distant future.

Conceivably it is possible to allocate weighting factors to the main mission objectives of the CG, such as safety of life, preservation of property, safeguarding the environment, law enforcement, reduction of floating hazards at sea. Such a weighting would probably not be possible except by historical assessment of how such decisions were made in the past in a manner judged to be satisfactory.

The CRT screens of all cognizant commanders would be confusing. Without the aid of electronic surveillance and a sophisticated C<sup>3</sup> system, the CG would likely send help to the vicinity of craft in trouble, and let the on-scene circumstance dictate the most appropriate action. Under this mode of operations, some craft would undoubtedly be succored, but this approach would probably produce a highly inefficient allocation of resources. Further, even with a super-effective C<sup>3</sup> system that computed the optimum allocation, the credibility of the picture put into the system would be suspect, because of the many uncertainties involved, and operating commanders with experience would be cautious in placing heavy reliance on such a system. It will take several years of experience before a sophisticated C<sup>3</sup> system has the credibility to justify

its use to experienced commanders whose sea-going judgement has been developed to a fine degree.

However, the system could calculate an optimum allocation of CG craft. Such a calculation would offer the commanders at least an approach that could be tested against their own judgement; undoubtedly the solutions offered would shed light on the problem and if the commanders were familiar with the system through actual use, they would benefit significantly from it.

One of the characteristics of this system is that it presents a continuously changing solution. As data on craft in the danger zone is acquired, and as the different craft in trouble are identified on the CRTs, the solutions will change and the optimum allocation will change. This will mean frustration to the operators, until they become accustomed to adjusting to the changes as they emerge from the system. But as the value of the system becomes more and more evident to the populace, more and more craft will equip themselves with transponders to facilitate identification by the TDNs and monitoring by the CG.

Another difficulty for the operators will be in keeping up with the continuously changing picture unfolding through the system. That ability is highly important because system errors will persist until corrected by operators who have the judgement of on-scene proximity. These errors derive from the natural manner in which data is entered into the system. Even though much of it is automated, much of it also derives from human inputs of sketchy validity. Part of the virtue of the system is the fact that bad data put in is constantly checked out against better data and scrubbed clean. A principal operator function is to constantly check the data being presented to insure that it is in fact consistent. The machine-computed products back-stop the human observers and vice versa.

Once the CG craft are on-scene they are then capable of ascertaining the

nature of the craft and their cargos quite accurately. Chemical devices placed into use downwind from the target craft pick up the most minute amounts of scent that indicate the nature of the cargo and personnel on board. These are augmented by laser devices that enable virtually microscopic examination of decks and rigging from a very considerable distance, acoustic devices that analyse radiated sound signatures, and IR receivers that analyse heat radiation patterns. When compared with the data in the NINs, these analyses provide clear evidence of the detailed nature of the craft being examined. All these analyses are performed automatically, with very little human intervention or inputs.

Once on scene, the CG craft can be put into a "HOLD PATTERN" relative to the target ship and automatically maintain station downwind from it, but offset sufficiently to prevent the ship, or debris from it, from being blown down on the rescue craft. This operation is comparable to the helicopter automatic hovering capability.

As the CG craft approaches the stranded ship, the CRTs in use in the C<sup>4</sup> provide continuous alert to the proximity of shoal water to insure that the rescue ship does not itself become stranded. The CGLC has options as to the margin of safety which he seeks to set into the system.

Once at the scene the CGLC puts his robot into action, boards the craft with it, and investigates as needed, including below-decks investigation. The television and radio in the robot permit the robot controller to walk the robot through the ship as if the controller were actually there himself.

#### SCENE B: SMUGGLING OPERATIONS FROM COLOMBIA TO FLORIDA

The situation: The Commandant and all subordinate commanders are at their respective desks or at home asleep. Tanker TUO (Tanker of Unknown Origin) goes aground in the Florida Straits and sends out an SOS message. (The situation

is the same as in Scene A start, but is repeated here for convenience.)

#### Intelligence & Surveillance System in Operation

NIN<sub>1</sub> has information that a fleet of craft are about to leave Colombia with a load of drugs; destination is the east coast of the U.S., presumably somewhere in Florida, but not certain. This information is fed into the other NINs and into the regional and district TDNs from CG HQ. The search modes of the TDNs covering the north coast of South America and the Caribbean are set to search from satellite photography and radar, airborne radar, and in passive modes of magnetic, electromagnetic, IR, acoustic, olfactory, or visual surveillance. Human-generated intelligence (HUMINT) is continually being fed into the NINs, and after filtering is then fed into the TDNs. An objective is to maintain the surface craft of the CG in readiness, but not to send them out until the minimum distance to target can be reasonably assured. A similar but lesser constraint applies to CG airborne craft other than routine patrol craft. This policy minimizes fuel expenditures, and maximizes the probability that intercepting craft will be available at the optimum times.

#### Target Acquisition & Identification

The CG District commander with cognizance is in frequent communications with his C<sup>4</sup> from the time of the original alert, and has alerted his interception forces.

A complication for the CG team is the large amount of traffic in the region. This may make it difficult to detect the movements of the sought-after smuggling craft as they depart Colombia. However, the use of coordinated surveillance devices, both active and passive, will minimize confusion if the operating personnel maintain alertness and check out all possible signals that could represent the smugglers. The measure of uncertainty can be reduced by collating received signals in radar, passive EM, acoustic, IR, and laser

examination from satellite station. The smuggling force will probably emerge from the South American coast line undetected and will be picked up by the surveillance systems only after it has set course for its destination.

The commander at CG HQ has the ability to call into view the CRT displays available to any of the subordinate commands, and can compare these with the picture he is receiving from the national intelligence nets (NINs). All of the stations can do this same thing, but the concentration of each station will be slightly different, depending upon its point of view. The local commander will be interested in acting as soon as possible, but not too soon. The commonality of interest at the various levels is far higher than at times in the past when the CG HQ command did not have access to the same picture that is available now. One of the Commandant's concern is that no surprises come at him from outside the region under surveillance.

One of the characteristics of the TDNs is the ability to check data for consistency. For example, when information on the smuggling craft is fed in from two different sources, it is checked for consistency and a signal to the operator tells him when there are inconsistencies. This does not automatically eliminate the inconsistency, but it does alert the operators at all locations to the need to do so manually.

A concomitant feature of the system is the capability at each station to admit or not admit data/information from another TDN; when the CGLC feels that he needs intelligence from outside his system, he can "open his gates" to all information or intelligence from higher level TDNs, or he can open only certain gates to this information, depending upon his needs and his confidence in his own data/information.

Each one of these operations to manipulate the system is quite simple to perform when taken by itself, but in order to gain flexibility, the system

must have a relatively complex means of selecting the combination of controls necessary to perform each function.

#### Target Tracking

As a pattern of movement in a particular group of ships begins to emerge from the traffic moving northward from Colombia, and as other signs from this group begin to acquire a degree of conformity to those indicated by intelligence, the CGLC moves into his C<sup>4</sup> and begins to maintain close observation. At this point, the characteristics of the craft, as developed through the NINs, are in the TDNs and as the data from the observed craft is fed into the system it is checked against the intelligence data. Signs from the system to the operators then tell whether these operators that the data/information is consistent with identifying the craft as the smugglers. Deviations are spelled out to the operators, who can then use judgement to conclude the implications of the deviations.

As the craft move on, the identity of the group becomes better and better established, and the CGLC gets a feel for exactly which craft constitute his targets.

During this process of increasing identification, the CGLC has been in close telecommunications and video communications with the next higher levels of CG command, with easy multiple-way conferencing on the video communications components of the TDNs.

#### Decision Making

At about this time the CGLC begins to alter the positioning of his surface forces in order to minimize time to intercept, once the command to intercept is given. These moves are with high confidence that they will not be unnecessary-- i.e. craft from distant bases are moved closer to the action, but craft already in relatively good position are left where they are. Aircraft and LTA are



alerted, but not moved.

During this time, the TDN calculates optimum strategies/tactics to accomplish the missions assigned and entered into the system. These strategies/tactics are in terms of when to move which craft toward which targets. The targets are spread over a considerable expanse of ocean, not nicely grouped into a "formation" to make it easy for the CG to track and intercept in one convenient maneuver. Therefore, the CGLC's approach is complex in terms of how to develop the most efficient and effective distribution of his forces. Here is where the TDN capability to calculate optimum solutions to resource allocation problems comes into full utility. And here also is where the operators' skill and judgment with respect to use of the system is put to the test. When the system is correct, the operators will achieve maximum use of the system by relying upon it fully. On the other hand, when the system is operating on erroneous data/information, the operators need to sense this fact, and accommodate for it. Even though the system represents an order of magnitude increase in overall tactical capability, it nevertheless does not mitigate the need for the operational commanders to remain "on top of the situation" every minute of the operation.

As the adversaries become more aware of the C<sup>3</sup> capabilities of the CG, they may be expected to counter with masking tactics of one kind or another--such as radiation of false electromagnetic signatures, electronic jamming, etc. Only a highly alert operational commander will detect these aberrations from the norms.

#### Commitment of Forces and Interception

At this point the TDN<sub>4</sub> has indicated to the CGLC the force allocation that will most efficiently and effectively intercept the smugglers, and the system maintains an ongoing solution to this allocation problem. Subject to his own

interpretation of the system picture, and to the continuing changes that the system is producing, the CGLC may at any time execute his decision to intercept. The system continues to calculate the optimum solution and also to calculate the time by which the best solution will no longer be available because of the movements of the adversary forces. However, here the judgment of the commanders may dictate that a change in this movement is more likely than the system seems to believe; thus the CGLC--usually with the consultation and concurrence of the higher level commanders--may decide to execute the command to intercept at a time different from that recommended by the system. Or he may decide to execute it in portions--a "piecemeal" execution--to give him a hedge on unexpected changes by the adversary.

During transit of own forces to intercept, the CGLC may be embarked in one of his craft, or he may elect to remain at his shore station. The capabilities of the TDNs will provide him with a complete picture of the on-scene situation at all times at either location, but most seasoned officers feel more comfortable operating with "first hand" observation. So unless the physical nature of the situation--like overcrowding of surface craft--precludes it, the CGLC is likely to want to be present on-scene in one of his craft. In any case, if he is not present in one of his craft, he automatically relinquishes a degree of his authority to the senior officer on-scene, who will always be considered to have the advantage of the "on-the-spot" view, and therefore with a degree of superiority of vision over all others in terms of the strictly local variables.

At this point each of the CG craft has been assigned a particular target to intercept, and is proceeding toward that target. As the NINs continue to feed into the TDNs, and as the judgement of the commanders at the different levels matures with respect to this particular situation, the picture may take

on new and different nuances and aspects, so that assignments may change as the force executes its transit. This will be accomplished easily and with minimum confusion to the individual ship and aircraft commanders because each has the facility to maintain an up-to-date view of the "big picture" throughout all the preparatory stages. (One of the hazards of sudden changes in orders heretofore has been the potential for confusing the recipients of these changes, when these recipients have not been assured the opportunity to keep completely abreast of the situation.) One of the features of the system is particularly useful at this point; this is the "What if.....?" query. Any commander has the capability to query the system, "What if I change ship A to target X?" "What changes will this make in the overall optimization of the solution?" or "What other changes will this make necessary in order to continue to optimize, subject to the change I just asked about?" Another query that any commander may make is "What if ship x in the adversary group changes course or speed to abc? What effect will this have on the solution we are pursuing?" Still another form of query that any commander may make is "What does the law/regulation/CG policy say as to .....?" Presumably all levels of command keep themselves up to date on such matters, but it may exceed the capability of any one person to keep abreast of the multiplying number and complexity of laws, regulations, and policies.

At this point each individual ship and aircraft commander is more or less "on his own" to execute his intercept, and then proceed to the next target assigned him. He will need to insure that data/information emerging from his operation is fed into the TDN. This will be facilitated by a certain amount of automatic feed-in, but certain categories of data will never be susceptible to automatic inputting and will require manual manipulation. For example, the exact nature of the smuggling craft may be obtainable only through on-scene instrumentation,

visual observation, robot boarding, and application of human judgment. The suspicions of the on-scene commander may be highly relevant, but not susceptible to injection in their early stages into the system. In addition, the observations of the on-scene commander may need the clarification that comes from discussion with more experienced officers. This will be facilitated by the video-conferencing components of the TDNs. Here again in order for the on-scene officers to inject data/information into the system in the most expeditious, efficient, and effective manner, they will all need to have an in-depth facility with the capabilities and limitations of the TDNs.

#### On-Scene Action

In this portion of any operation the TDNs interface with operating personnel will be most important. It will be possible, for example, for video tape equipment to pick up a great deal of information on-scene and inject it into the system, but this may be largely unedited and unscreened. It always takes time and concentration for an on-scene official to translate his observations and evaluative judgements into concise language for inclusion into any reporting system. The advent of the TDNs, including robot technology, will facilitate this process, but it will still be complex. Videotapes of the action will help staff clerical personnel translate the observations of on-scene officials into the TDN language. The capability of on-scene personnel to use video equipment at the height of an action will still be limited.

Policy/procedural guidelines to TDN users will give priority to the kinds of entries to the system that are expected to be most useful to the higher commands. For example, it will be possible to instruct the TDN<sub>4</sub> users to inject certain information into the system, and to assess international implications of an action early in the process.

As the action progresses, the CGLC allocates his forces to intercepts as

recommended by the TDN but modified by his own judgement. Information as to the nature and quantity of the contraband confiscated is passed into the system and on up to the higher echelon systems. Accommodation is made at all levels to the fact that initial information is often incorrect, and that as time settles the emotional states of those reporting it, and as more detailed and more reliable information is uncovered, a more accurate picture develops.

The action reported here concludes with a number of craft being apprehended and taken into custody with prize crews. Portable TDN equipment is placed on board the prizes in order that the safety of CG personnel and security be maintained. Constant video communications with the prize crew commander is maintained at several levels of command within the CG, and his safety and security are monitored closely.

#### SCENE C: FOREIGN POACHERS IN U.S. FISHERIES

The situation: The Commandant and all subordinate commanders are at their respective desks or at home asleep. Tanker TUO (Tanker of Unknown Origin) goes aground in the Florida Straits and sends out an SOS message. (Again, this is the same situation as in Scene A, repeated for reading convenience.)

#### Intelligence & Surveillance System in Operation

Reports from U.S. fishermen about 150 miles off the coast suddenly advise that unidentified large ships are sending small boats to encroach upon the fishing operations of U.S. fishermen. It is unclear as to exactly how this encroachment is taking place, except the agitation of the U.S. fishermen is at a high level.

The NINs have no information that leads clearly to foreign intent to disrupt U.S. fisheries, but for the past several weeks there have been a number of unidentified ships in transit in the vicinity of the U.S. fishing grounds, identified tentatively from satellite and airborne sensors as either pleasure

craft or U.S. fishermen without transponders or other electromagnetic identification.

#### Target Acquisition & Identification

The fishermen's reports of disturbance activate the NINs and the TDNs to step up their investigative capability and apply it to this situation. HUMINT, communications intelligence (COMINT), and electronic intelligence (ELINT) means are immediately activated as well as radar, IR, visual, photographic, laser, and acoustic surveillance measures at one level of intensity higher than has been operating to this point. All of the foregoing takes place within minutes of the first fishermen's report. At the same time CG air patrols locate the fishermen making the complaints, talk to them from the air, identify the suspected poachers, and begin to pick up surveillance information on them--visual, IR, active radar, passive electromagnetic, laser, chemical, magnetic, acoustic, photographic. The TDNs are sufficiently sophisticated that they can receive this surveillance information, filter it through identifying characteristics, and present an initial estimate of the identity of the poachers. This can be done for the benefit of the intermediate TDNs and for feed-back into the NINs. The system then presents probability estimates to its users in the form of probability distribution curves or bar graphs (histograms) with confidence levels and confidence limits.

This feature of the NIN/TDN system has become more and more useful as personnel become educated into the use of these statistical devices--probability distribution curves, histograms, and the concepts of confidence levels and limits. The credibility of these concepts has increased with use as the personnel discover that they are not particularly abstract concepts, but merely different ways of presenting "common sense" descriptors. The credibility awarded the use of these devices increases as personnel see how their own inputs into the system change the shape of the curves and histograms, increase the confidence levels,

and narrow the confidence limits.

#### Target Tracking

At this point the TDNs maintain a track on all the craft concerned with the same instruments and vehicles that established the location and identity of these targets.

#### Decision Making & Commitment of Forces & Interception

As in the case of Scene B, at this point the CG alerts its forces to intercept and impose ELT action. The action proceeds as in Scene B up to and including interception. Then the CG encounters resistance by force to CG boarding the craft. This requires the Coast Guard to apply robot boarding, and nonlethal weaponry--such as incapacitating gas guns, and possibly laser guns. In the use of these weapons, the TDNs become very active as on-scene commanders engage in extensive videoconferencing with higher level commanders.

The process from here on is similar to that of Scene B and will not be described further.

SCENE D: U.S./U.S.S.R. (AS PROXY FOR LIBYA) CONFLICT ON NODULES 1000 MILES OUT

The situation: The Commandant and all subordinate commanders are at their respective desks or at home asleep. Tanker TUO (Tanker of Unknown Origin) goes aground in the Florida Straits and sends out an SOS message. Additional information is as follows. UNCLOS III was never completed and the U.S. and third world countries have never agreed as to ownership or operating rights in harvesting sea-bottom nodules. Nevertheless several U.S. companies, backed ambiguously by the U.S. government, have invested heavily in development and installation of plant and equipment to mine these nodules at considerable distance from U.S. coast lines. An ongoing operation has existed for several years, with only minor conflict with other nations. It has been assumed by most U.S. officials that the reason for the lack of conflict has been the lack

of capability by the other nations more than the lack of willingness to contest the U.S. position and action.

Despite the ambiguity, however, the U.S. has taken no stand as to what action to take--especially by either the CG or the Navy--in the event conflict does in fact arise at the scene of U.S. company mining operations. Thus the news at federal government offices of the emerging conflict causes great concern and uncertainty as to what course of action to follow. This is particularly so at CG HQ. The CG perceives itself to be on essentially the first line of action, but in view of the ambiguity as to whether ELT action or hostile military action is taking place, the CG HQ has no guidelines as to national policy for action. Communications with the Chief of Naval Operations reveals an equal concern and uncertainty as to roles.

#### Intelligence and Surveillance Operations through Commitment of Forces and Interception

Despite the uncertainty, the Commandant feels that he cannot go wrong by positioning his forces to take action if necessary. The Navy apparently feels the same way. So both high commands direct forces to the scene to stand by.

The facility of the NINs to integrate with each other pays off in this situation, because both Naval and CG forces feed into their respective TDNs and in turn to the NINs. The capability of the systems to cross input data/information, and to tap information/intelligence from each other provides the operational commanders with as clear a view of the ongoing events as it would be possible to acquire. In view of the political and policy ambiguity prevailing, this becomes a very significant asset to the operating forces. Using abandoned oil rig platforms as bases, the CG sends cutters and helos out as far as the logistics will permit, and the Navy sends its large high endurance ships out even farther into the zone of contention.



#### On-Scene Action

At this point the problem becomes one of information gathering and flow. As the situation develops at the scene, the CG and Naval forces stand by awaiting orders as to the extent of U.S. intervention, but in any case to protect the physical safety and security of U.S. personnel and property.

All the NIN/TDN capability described under Events #1 through #3 have application here, and in addition the intelligence gathering capability of these systems is brought into full force. In the other scenes the intelligence producing capability has been emphasized. For this operation the other strength of the systems comes into focus: the operating units now become intelligence producers more than intelligence users. Their ability to pick up with local instrumentation the nationalities and other characteristics of the ships and aircraft causing the trouble to U.S. companies is put to full use.

In this case it turns out that the nation initiating the disturbance is Libya, aided in terms of on-scene ships, aircraft and mining equipment by the U.S.S.R. The U.S. considers this incident explosive in that confrontation with proxies has to this point been with the proxies of the U.S.S.R., rather than with the U.S.S.R. as itself a proxy. So the intelligence gathering function here becomes significant.

#### Post-Event Action -- All Events

The TDNs at all three levels have the capability to play back any of the events recorded. As a consequence, these systems have the capability to recreate sufficient detail for all required action reports, and for all required post mortem analysis. These play-backs can also be used for forensic purposes.

## CHAPTER 2: ENVIRONMENTAL PROTECTION SCENARIO--FOUR SCENES

The set of scenes in this chapter are based on the assumption that the system of environmental protection described in summary fashion in Chapter 5 of Volume I is developed, and that the detailed technological forecasts elaborated on in Chapter 7 of Volume I occur. In other words, Chapters 5 and 7 of Volume I form the foundation upon which these scenes are based.

### BACKGROUND

In these scenarios the Coast Guard is placed in the role of centralized marine manager; this is not essential to the unfolding of the events of the scenes, nor to their richness as vehicles to depict possible futures. Some other agency could perform the role of central manager and not weaken the value of the scenes. However, it is considered that the greatest responsibility in that role would fall on the Coast Guard, and therefore a presentation in that form would be more likely to reveal challenging problems/opportunities than any other.

For this series of scenes it is postulated that several command nets exist. They are depicted here as though they were nets dedicated exclusively to the environmental protection function; however, we do not forecast that this would necessarily be so, and the utility of the scenes is not sacrificed if it is assumed that each station of the nets is but a component of a station in another more universally applicable net--e.g. a station in a world-wide C<sup>3</sup> net serving myriad other functions in addition to environmental protection.

Given this backdrop then, the scenes operate against the following conditions: The anticipatory marine management/sea use planning system has developed along forecast lines. The entire region of U.S. maritime economic influence (including The Great Lakes) has been divided into numbered grids. These grids are the basic units of environmental monitoring and sea use management. Development of Georges Bank petroleum reserves, after bitter political struggle,

has gone ahead. The potential oil and natural gas producing areas have, following prolonged, acrimonious international debate, been divided among the states having "close" contiguous coastal zones: U.S.A., Canada, and Denmark (through Greenland), much as the North Sea was apportioned. Monitoring and enforcement responsibilities are shared among the three nations, although all environmental enforcement operations are under the control of the U.S. Environmental Protection Officer for the New England Region since U. S. monitoring capability is by far the most sophisticated. The same shared environmental control/monitoring responsibility is in place between the U.S. and Canada for the Puget Sound area, north to Alaska and into the Southwestern Arctic production fields.

A number of surveillance, monitoring, and communication networks interlock to form the environmental protection control system. Beyond routine monitoring of environmental conditions, the net and each region's Environmental Protection Officer is charged with coordinating the operational performance standards, zoning requirements, and sea use management for that region. The regions generally correspond to Coast Guard organizational regions.

The basic network for environmental monitoring of Environmental Data Net No."n", (EDN)<sub>n</sub>\*, is a series of linked environmental surveillance devices. Each station with these devices uses floating data bouys, acoustic, optical, chemical and electromagnetic monitoring stations fixed to working rigs and platforms, subsurface acoustic, optical, chemical and electromagnetic arrays and sampling systems, and environmental monitoring instrumentation "piggybacked" onto intelligence, navigation and communications satellites. A dedicated environmental monitoring satellite system has been in the planning stage for about 20 years, but its high cost has been perceived as not warranting its

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\*Where the subscript "n" is equal to 1,2, or 3, indicating respectively national, regional, and local nets, corresponding to the notation used in the C<sup>3</sup> scenario.

installation.

The Regional Environmental Zones Management Center (EZM)<sub>n</sub>\* also receives input from other sources. Intelligence data sources are programmed to automatically input unclassified information of relevance into the Environmental Protection (EP) system, including weather, ship and marine life movements. Similarly, the Navy's surveillance stations place unclassified input into the EP systems, particularly from underwater acoustical arrays. In each case, the operator of the classified systems has the authority and capability to route some normally classified data into the EP computer, should it be authorized. Additional inputs come from Weather Service, NASA, and NOAA information gathering systems. Inputs are also supplied by the Coast Guard's own net (NIN<sub>3</sub>/TDN<sub>1-3</sub>) of which the environmental net is a part.

Central to its mission, the EDN<sub>1</sub> and EDN<sub>2</sub> are programmed to automatically make comparisons. They compare the real-world conditions indicated by data inputs against the environmental models incorporated into the Sea Use Management System\*. Any deviation is displayed for the on-duty Environmental Protection Officer (EPO) with suggested causes and "best" remedy. The suggested mitigating alternatives could range from doing nothing because the situation is not dangerous, to shifting performance standards for bottom turbidity, to dispatching a mission because of a severe violation of environmental or sea use regulations.

Overall control of each region is exercised by a Regional Environmental Protection Officer (REPO). The EDN<sub>1-2</sub> net feeds into a Central Environmental Zones Management Center (CEZM) in Washington. National managers may then coordinate among regions, allocating resources among regions in the event that excessive demands are placed on two regions at the same time. These managers maintain continuing overview of the marine environment. Relevant information may be

\*For description of the "model" see page 7-6 in Volume I.

routed to REPO's through the national Center.

The system has the capability to alert the EPO and REPOs of potentially hazardous environmental problems (such as harsh weather affecting a platform, or seismic indications of an earthquake) allowing for anticipatory mitigation. Display options include CRT, videoconferences, teleconferences, analogue presentation, statistical presentations, pictorial and holographic images. The operators have a large number of query options, ranging from: "What is probability that....?"; "What if.....?" to specifics such as: for a particular grid number, water quality performance in real time versus theoretical model; or predicted wave height at a specified location.

Programming for the system is at different levels of complexity, from built in capability for basic software to operator programming. Unfortunately, personnel fully qualified to operate the system to its limit at any level are scarce. The CG and other governmental environmental agencies have similar trouble finding qualified operators for clean-up equipment and environmental protection/"processing" systems. Qualified EP operators/programmers and work boat masters are in high demand by offshore industry and municipal waste treatment facilities to man their own monitoring/surveillance/ biochemical systems. That conflict has driven wages for qualified personnel very high.

One impact on the CG is that the EDN and EZM Systems have become, in a sense, a training school for private sector marine operators. Just as operators, programmers and work party leaders become proficient, they are heavily recruited by the private sector.

Each regional center is the hub of a sophisticated communication net among marine and coastal zone operators, coastal margin industry/urban treatment processors, and the REPO. As operators' sensors record environmental changes, they must constantly adjust environmental technology such as on-board chemical modifi-

cation of effluent or "processing" of solid waste. Each shift in performance is received and recorded by the EZM so that the real time model of the region's ecology is continually up-dated. If modifications are dictated by conditions outside of the range of an operator's monitors, the EZM informs the operator of the upcoming change. Similarly, the operators, based on local data, may suggest performance modification to the REPO. Thus performance regulation to protect the environment, when functioning smoothly\*, need no longer be strictly an adversary relationship between ocean business and government.

Regulation of inland waterways, local inland sewage/waste treatment and on-land environmental protection is carried out by a similar system. Control of that system, however, rests with individual states. Coast Guard cleanup or chemical treatment teams are available to the cognizant state agency on an "as needed" emergency basis, subject to a user's fee to offset the high cost of air-lifting to and maintenance at the spill state.

While an independent command, CG and civilian elements of the CZM are integrated with the CG C<sup>4</sup> system. That gives the local Coast Guard commanders environmental data when they need it, allows the EPO/REPO to use CG resources as he needs them, and, when the situation requires it, provides for unified command and control when EP elements and tactical forces are both required for the same mission, e.g. scenarios A and C-7 below. Similarly, display screens are placed in each state's cognizant environmental or CZM agency, insuring state input into the system while providing state officials with real time information on the state's waters.

The scenes which follow describe the key elements of the functioning EZM sys-

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\*That may, at times remain a large assumption. Some types of operations still may have different operating standards. This means that a sea range operating near the edge of one use zone and a mining operation near the limit of another will still have use conflicts which must be resolved.

tem. Each event is described in some detail because, while many of the events share much in common, the operational problems are quite different. The common routine matters faced by the EPO/REPO in daily operations are:

1. Determination that the ecosystem use model for each grid is being followed.
2. Deciding what measures are necessary to keep actual conditions and model in equilibrium.

EPO/REPOs have the additional difficulties of:

1. Identification of potential problems
2. Determination of the best solution of problems
3. Determination of the need for on-scene cleanup or investigative forces

The format of each scene is a sequentially numbered, step-by-step outline of its unfolding.

#### SCENE A: POTENTIAL EMERGENCY SPILL: TANKER AGROUND

1. 1800 Hrs. EZM for Gulf region receives information from EDN<sub>2</sub> multisensor data buoy system that contaminant of some type is appearing in region of data buoys. Within minutes information is also received from local command net (C<sup>3</sup>) whose input was satellite sensor, that tanker is aground off Florida Gulf coast. The system's instrumentation consists of salinity, temperature and depth sensors, a high resolution bottom-scanning sonar, an electromagnetic current sensor, miniaturized multiplexed acoustic array, PH and ion detector, wave height and wind speed/direction sensor, and an x-ray fluorescent system to detect chlorophyll and oil within the water column while monitoring suspended solids to measure bottom turbidity.

- a. REPO alerts regional strike force CEZM with message, "Preparing to assist tanker aground. Will advise intended action."

1) Chemical carrying helos placed on stand-by.

- 2) Environmental cleanup/containment work boats placed on stand-by.
  - 3) Begin monitoring and query data buoys for reading from gas chromatograph and x-ray fluorescence to determine type of petroleum. (Required in order to design best treatment for biodegradation in those waters, under existing weather pattern, and for specific type oil indicated.)
- b. Track real-time projection based on actual monitoring of environmental conditions assuming "worst case" amount of spill based on tanker size.
- 1) Determines estimated time of arrival (ETA) of spill in location listed as "Environmentally Sensitive Zone" providing habitat for the endangered species Manatee Trichechus (a form of sea lion). Determines that a large spill, given present conditions, would threaten life in zone. Estimates spill will arrive before biodegradation is complete.
  - 2) Spill trajectory would also impact OTEC plant in region, and pass within "Use Zone" of a sea ranch. OTEC facility and sea ranch alerted.
2. Task Force containment work parties are assigned stations for setting booms, barriers, gelling agents and skimmers to contain spill. CEZM advised.
- a. Sea ranch advises that at this time of the year zone is "empty"-- i.e. no hazard to life.
  - b. OTEC plant advises that if spill is under "y" barrels and concentration under "x" parts, it can handle spill with own chemical treatment, and no assistance. Asks REPO (or if necessary EPO) to advise as to best chemical formula for biodegradation procedure.
3. Containment forces reassigned to provide maximum protection for endangered species habitat.
4. On-scene data from CG operational units input via TDN<sub>3</sub> indicates no major spill. CG operational units on scene have capability to handle small seepage. Biodegradation will be completed well before environment threatened.
5. 1820 hrs: All EP units stand down.

Variation A-1: Major Spill From Tanker Aground

- 1-3. Same as above through number 3.
4. On-scene data from CG operational units and satellite surveillance data



indicate Very Large Cargo Carrier (VLCC) with major rupture, 200,000 bl. spill.

- a. EP helos, equipped with low-light T.V. and microwave imager allowing optical monitoring by REPO, dispatched to begin chemical treatment.
  - b. Containment assignments reassigned to provide assistance for OTEC facility.
  - c. Florida State Department of Wildlife advised by EPO, who in turn has been advised by REPO, of danger of impact on environmentally sensitive area. Volunteer local environmental group mobilized to move into sensitive area to assist with decontamination.
5. Helos, the first units to arrive on the scene, begin chemical treatment of spill, based on projected track of spill.
  6. Spill breaks out of small temporary containment set by first on-scene CG units.
  7. Surface units of EP task force arrive on-scene, set containment barriers and begin chemical treatment.
  8. Helos continue treatment of trajectory of residual spill. Sensors determine that oil in spill is biodegrading.
  9. Barriers to protect habitat and OTEC facility placed, and work boats begin pretreatment of trajectory, working back toward the actual spill.
  10. Wildlife experts from the state of Florida, augmented by volunteer groups, begin pick-up of birds coated by slick.
  11. Zero relative velocity skimmers (see "ZRV Skimmers", Chapter 7, Vol I) begin pick-up of treated/gelled residual slick.
  12. EP Task Force at tanker maintain barrier until biodegradation reaches safe level.
  13. Mission complete. Environmental damage minimal. Computer projection of distant effects of residuals used as basis for follow-on monitoring of track.

Variation A-2: Potential Blow-Out on Platform

1. Warning lights on operator's console on drilling platform in Baltimore

Canyon indicate blow-out danger resulting from drill units striking high pressure gas pocket.

- a. Composition of drilling mud automatically changed by rig's computer and EP system to the correct viscosity to maintain hole pressure. Data automatically input into EDN at South Atlantic EZM where alarm sounds. Computer-controlled blow-out preventer activated.
  - b. Alarm sounds as data automatically routed to Regional Environmental Task Force Headquarters warning of possible well-head blowout.
  - c. REPO queries C<sup>3</sup> net for status and location of closest CG forces available to assist in emergency.
    - 1) Screen indicates location of ships available for an emergency rescue/containment mission. Shows readiness and availability.
    - 2) REPO requests these forces from CG operational commander.
    - 3) CG regional commander inputs "OK" into the net, which automatically assigns those forces to control of REPO.
2. Operators at Platform determine that automatic emergency procedure has obviated problem; hole pressure is under control. No blow-out potential, so drilling returns to normal. Message "operations returned to normal" entered into system.
3. REPO queries platform for data on environmental performance of modified drilling muds.
- a. The chemical and x-ray fluorescent sensors in data buoys and in platform sensors instantly monitor the environmental impact of the changed drilling mud, sending the processed data to the rig's computer which controls the chemical processing of wastes and muds, and which routes it to the EMZ through the C<sup>3</sup> net.
  - b. All EP and CG units stand down

#### SCENE B: POTENTIAL STRESS CRACK IN OIL PIPELINE

1. Daily operation of subsea well heads in the Santa Barbara Channel pumping directly into pipeline to offshore refinery. All operators' indicators normal.
2. An oil company work boat towing an x-ray fluorescence system on a routine

scan monitors the beginning of a stress fracture in a section of the pipeline. The pipeline is encased in a fluorescent material containing small amounts of chlorophyl (enough to be sensed--about 2 parts per billion--but not enough to cause an adverse environmental effect). As stress begins to affect the pipe, the chlorophyl is released into the water. The towed x-ray fluorometry system detects small changes in chlorophyl concentration, as well as suspended solids to indicate bottom turbidity.

3. Warning light flashes on operator's console and computer begins automatic shut-down of wellheads and pipeline. EZM notified and request placed for cleanup assistance to be placed on standby.

4. Automatic shutdown of wellheads completed, through-put continues in pipeline. Automatic emergency shut-off valves close threatened section, isolating and emptying the area.

5. Repair effected on section, through-put restarted. Wellheads reactivated.

#### Variation B-1: Earthquake threat

1. Same as scene B, number 1.

2. Seismic instrumentation inputs to EDN and EZM indicate precursors of earthquake. REPO sends emergency warning to all impacted operations and routes data through local, regional and national command nets.

3. All operational units--production platforms, drilling operations, refinery and transshipment facilities--begin shut-down and emergency capping procedures.

4. Regional Task Force ready for multimission response. EPO requests added resources from CEZM.

5. Small quake (1.2 on Richter scale) impacts Santa Barbara area.

6. Overall damage minimal: two wellheads leaking trace amounts of natural

gas and new natural petroleum seep detected.

7. Environmental Task Force begins operations.

- a. Aerial chemical treatment mission from Northern Pacific ordered by CEZM to be applied at natural seep so that regional efforts can deal first with leaking wellheads.
  - b. The leaks and seeps are sensed by chemical "sniffer" monitors towed through the impacted area by oil company and CG environmental protection workboats, subject to assistance and verification by satellite multispectral scanner. The chemical sensor's underwater instrumentation consists of salinity, temperature, and depth sensors, bottom-scanning sonar and electromagnetic sensors in addition to the chemical system--a multimission monitor. The system continuously analyses dissolved hydrocarbon gases, methane, ethylene, ethene, propane, isobutane and n-butane. Significant quantities of the higher molecular weight hydrocarbons are not produced by ongoing biological processes, so if sensed they are interpreted as an indication of either natural (i.e. in this case earthquake originated) or man-induced sources of contamination; the ratio of concentrations of natural vs. man-made hydrocarbons are different, so each source can be identified.
8. Most environmental damage mitigated as biodegradation effected. Birds impacted by slicks biggest problem; taken under cognizance of Wildlife agency.
9. Environmental model programmed to assess impact of quake, and to indicate standards required to maintain ecological balance in quake's aftermath.

SCENE C: VIOLATION/VARIATION OF PERFORMANCE STANDARDS

General background of scene:

Events in this scene take place during a normal shift performing routine monitoring of a specific region: e.g. New England Sea Use Zone, Freeport to Cape Cod. The last event, number seven, is a routine surveillance mission that results in the final scenario, Scene D.

1. Regional EPO on duty supervising operators monitoring area.
2. Crew of drill ship Carl Yastrzemski reports chemical and fluorometry sensors indicate drill muds impacting diurnal oxygen curve and creating bottom turbidity exceeding performance standards. Crew changes viscosity of drill muds and drilling speed to effect correction of bottom turbidity and oxygen imbalance. REPO punches new data into computer, asking for projection from model. Display indicates ship's mitigation techniques will effect desired change, REPO sends

concurrency to crew.

3. Input from intelligence satellite shows school of Yellow Tail Flounder migrating into a "mixed use" region of the sea use grid.

- a. A floating combination refinery facility is notified of movement and resulting shift in performance standard for biochemical "processing" of waste material. Performance standard of effluent formula switches to a chemical modification providing nutrient for Yellow Tail Flounder.
- b. EPO sends input on fish movement to Fisheries Information Center where it is available for dissemination to fishing boats.

4. Aircraft flying SAR mission reports detection of traces of untreated oil slick. EP chemical treatment helos ordered to treat slick.

- a. Oil classification run through AMVERS and intelligence component of the C<sup>3</sup> system to determine source.
- b. Command and intelligence C<sup>3</sup> nets queried, based on real time, actual on-scene conditions, for backward projection of trajectory by computer model for possible location of violator.
- c. Tanker X at location Y identified as source: overaged Liberian registered vessel.
- d. Tanker contacted by radio. Master reports malfunctioning oil/water separator-chemical treatment unit and accidental cleaning of bilges.
- e. Tanker complies, verified by surveillance satellite, with order from REPO to stop cleaning bilges.
- f. Owners notified of fine for illegal dumping and assessment of "user's fee" for biochemical treatment of slick levied by REPO's regional administrative law judge.
- g. Full recorded data on incident inputted into federal district court.

5. Input placed into EDN<sub>2</sub> by classified Navy underwater acoustic array indicating unusual sounds from a particular geographical grid location.

Signature indicates sequential vertical motion, such as could emanate from large scale lowering/raising of lobster traps. Region in question is in freeway for underwater pipeline from Georges Bank production field and shipping lane to Boston Harbor. Bottom-oriented fishing is not permitted.

- a. REPO dispatches patrol boat from Kennebunkport to investigate.

- b. Lobsterman found in act of lowering traps. Computer indicates second violation in same use area for boat. REPO passes to legal processing for administrative law judge action.
  - c. Data on case routed to federal district court.
6. Input from Weather Service and EDN<sub>1</sub> sensors give indications of a shift in barometric pressure with shifts in wind direction and speed for grid coordinates directly impacting Boston air quality. Floating electric power plant fired by natural gas pumped directly from Georges Bank field notified that this shift will occur at approximately xxxx hrs.. This change in wind speed and direction will necessitate modification of air quality performance standards for the facility, since its smoke will no longer be dissipated at sea but will be carried over Boston. Power plant informed by REPO that as of xxyy hrs it must place its energy intensive smoke stack scrubbers in operation. Power plant sends acknowledgement.

Note: Since the use of scrubbers adds significantly to the cost of electric generation, flexible air quality standards are based on the need for that expensive process. In this case, under the prevailing wind pattern emissions are dissipated without harm. Therefore extra "technology forcing", costly standards are mandated only when atmospheric conditions would in fact lower air quality.

7. Environmental monitoring data buoy senses small amount of untreated effluent, oil and traces of "dirty" drilling mud, drifting into surveillance area. REPO orders on-scene environmental computer backtracking of trajectory to locate probable source.
- a. Display maps indicate that the untreated waste originated in locality of Production Platform Alpha "A" and pinpoint its location, the Southwestern-most platform in the U.S. sector of the Georges Bank field.
  - b. Platform does not respond to REPO's call for explanation.
  - c. Since this is an environmentally sensitive area, REPO follows SOP and punches data into command nets, and initiates a videoconference among CG regional Commander, CEZM, CG Headquarters and REPO's senior environmental staff. Still no response to efforts to contact platform, but water column contamination indicates that its on-board chemical waste processing system is not functioning.

SCENE D: ROUTINE ENVIRONMENTAL MONITORING GIVES FIRST WARNING OF TERRORIST  
ACTIVITY

1. As data from C above (paragraph 7) is entered into the C<sup>3</sup> nets, overflight by the nearest available aircraft is automatically indicated to the EPO by his computer.

- a. EPO queries his command and intelligence nets for the location of ships (CG, Navy, Canadian or Danish) in position for surface reconnaissance. Upon receipt of information he inputs "O.K.", thereby assigning ship Z at location X mission. (Ship is a navy frigate on scheduled ASW operation.) Query automatically inputs through the C<sup>3</sup> nets to the U. S. Navy nets. Naval commander decides to permit the assignment, inputs his "OK" into the system, and the EPO takes operational control of the frigate.

2. EPO asks system to replay last watch's data inputs for the relevant grid and platform area. Discovers input from classified Navy underwater acoustic array indicating activity of company work boats in area.

- a. Queries computer to run cross check for scheduled activities. Learns that last night's was unscheduled. Inexperienced junior operator had not bothered to check when data was received because the signature matched that of an authorized vessel.
- b. Operating company contacts EPO, advising of irregular activities among his work boats, with some of them overdue at St. Johns, and that company has not been able to contact the platform for last 30 minutes.

3. Based on suspicious activity, and evidence of malfunctioning waste processing system, EPO places environmental cleanup Task Force on standby and asks through C<sup>3</sup> system for location of any ships that may be able to render assistance, if required.

4. On-scene air reconnaissance reports indicate platform is shut down, no workers visible.

- a. Working assumption at video-conference becomes that the platform may be the target of terrorist team. Unified marine tactical force notified. Its commander joins video conference.
- b. EPO queries his computer model, "What would be the effects of a major blow-out?" and "What mitigating action does the model indicate?" Computer responds with "ideal" solution to blow-out eventuality.

- 1) All parties at video-conference agree with the "ideal" solution proposed by the system. EPO assigns his task force positions (including Canadian forces whose EPO is now hooked into video-conference). CEZM places all East Coast Environmental units on standby with assigned positions, and activates contingency plan for airlift of Great Lakes team.
- 2) EPO assigns positions to vessels already identified and asks for status of other ships and aircraft available.

5. EPO, in consultation with his REPOs, requests all platforms in nearby areas to modify their on-board processing systems to provide a strong chemical nutrient in an attempt to attract fish out of potential spill area.

6. Radio transmission from platform announces that it has been taken over by elements representing Puerto Rico Libre. If the U.S. does not grant Puerto Rico immediate independence, terrorists will open wellheads on producing holes controlled by platform and allow drilling operations to blowout.

Terrorists also claim capability to attack work boats and helos if containment or air pretreatment is attempted.

7. EPO places his forces under command & control of special unified marine antiterrorist tactical force. Military command system begins control of environmental units leaving port to coordinate them with tactical objectives as well with environmental objectives.

8. For the remainder of the operation, the EPO and his environmental forces become a component of the military command system.



### CHAPTER 3: WATER SHORTAGE SCENARIO--TWO SCENES

This chapter presents the scenario of the impact of a critical water shortage in the year 2005 on Coast Guard roles and missions. The presentation is slightly different from those of the other "Scenes" because first, the theme tends to be more problem than opportunity, and second the problem is likely to be resolved by other than strictly technological innovation. This scenario reflects the conclusion the water shortage problem is more likely to be resolved through accelerating the movement of industrial activity seaward than through technological innovation.

Chapter 8 of Volume I contains technological detail in support of this chapter.

#### BACKGROUND: CRITICALITY OF THE WATER SHORTAGE PROBLEM

Inadequate surface-water supply: Localized problems have been identified in all water resource regions, with critical problems of inadequate surface-water supply in 17 subregions by 2000.

Fresh-Water Streamflow. Even in areas of high precipitation and streamflow, a series of dry years sometimes occurs, resulting in serious droughts. Effects of droughts are particularly serious in areas that use a high proportion of the available average annual runoff, where storage and distribution facilities are inadequate, and where sufficient carryover during prolonged periods of low water is necessary to send water to political subdivisions downstream. In the humid East, streamflow varies less than in other regions.

Overdraft of ground water: The worst problems are in the High Plains area that extends from Texas to Nebraska, Central Arizona and parts of California. In some of these areas ground-water levels are declining from 7 to 10 feet per year. There is more than 12,500 million gallons per day overdraft in the Texas-Oklahoma High Plains area, an amount about equal to the natural flow

of the Colorado River. In some areas, water is being drawn down as much as 18 times faster than it is being replenished.

Use of ground water for fresh-water supplies has been increasing gradually. During the last 25 years total fresh-water withdrawals increased at an annual rate of 2 percent, whereas fresh ground-water withdrawals increased 3.8 percent per year.

California extracted more ground water than all of the eastern regions combined. Of the total fresh water used in California in 1975, 48 percent was obtained from wells, or 23 percent of the total national ground-water withdrawal.

Irrigation is a principal use of ground water. It accounts for about 68 percent of all ground water withdrawn and about 35 percent of all water used.

The water shortages of the Southwest pose serious difficulties for the nation as a whole. As unbridled population growth strains the overtaxed water supply, Southwestern food production has already begun to suffer. Construction of the MX missile system is jeopardized for lack of water as well as political opposition. That system would be the largest engineering project ever built, covering 7,000 square miles of Utah and Nevada, and using more concrete than the entire interstate highway system. The U.S.'s relations with oil-rich Mexico may degenerate further if we continue to short-change Mexico by sending reduced volumes of saline water down from the Colorado. Without enough water the West's crucial energy resources--oil shale and coal--will never be developed. It takes 3.6 barrels of fresh water for each barrel of oil extracted from shale.

The Colorado River is the only significant source of surface water in the Southwest. More Colorado water is allocated to users than the river carries. Farmers and ranchers use almost 90 percent of its waters, a share which will decrease as water prices rise.

Pollution of surface water: Historically, streams, rivers, and lakes have been dumping areas for human and animal wastes and residuals from indus-

trial production. The majority of the population also has depended on these same sources for its fresh-water supplies. Pollution also originates from dispersed sources--33 percent of the oxygen-demanding loads, 66 percent of the phosphorus, and 75 percent of the nitrogen discharged to streams comes from dispersed and agricultural sources. With increased urbanization, the problems of accelerated storm-water runoff and associated nonpoint pollution will become more difficult to solve. Public spending to alleviate impaired quality conditions is beginning to approach the total expended for all other water-development purposes.

**Eutrophication:** Causes excessive growth of algae because of a large supply of nutrients. Foul odors and fish kills resulting from the decomposition of large amounts of organic materials limit the usefulness of the water. This has occurred in all regions of the U.S.

**Acid Rain:** Acid rain is increasing as a result of industrial discharge of pollutants higher into the atmosphere from the increasing use of taller stacks. These taller stacks release contaminants at a higher altitude, permitting prevailing winds a greater opportunity to carry them aloft. Many lakes and ponds have become "dead" and will not support fish.

**Pollution of ground water:** Ground-water pollution poses a significant health threat, with 40 percent of the population deriving drinking water from ground-water sources. Areas of ground-water pollution have been identified in almost all U.S. regions. Contamination of groundwater with toxic chemicals, insecticides, and herbicides is a threat to water supply. Ground-water pollution from septic tank drainfields and, increasingly, from livestock yards, animal feedlots, seepage from solid-waste landfills and discharges of toxic and hazardous materials is becoming more of a problem. Mining, especially surface mining, adds large quantities of toxic wastes to ground water. Withdrawal of fresh

water near saline ground water aquifers can cause the migration of saline water into the fresh-water zone, making it no longer potable. Once an aquifer becomes polluted, recovery is slow because of the slow rate of water movement through the aquifer. Groundwater pollution is a semipermanent condition, lasting for years after the source of pollution has been stopped.

Quality of drinking water: Pollution of surface and ground sources of public water supplies has serious potential public-health consequences. Most surface water receives extensive monitoring and treatment, and ground water receives at least chlorination. In rural areas, the potential health hazard is significant. Since about 1970 the incidence of waterborne illness due to bacteria or viruses and chemical poisoning has been increasing. Since a safe drinking-water supply is essential to good health, steps must be taken to prevent the increase in pollution of surface and ground sources of public water supplies.

Flooding: By 2005, potential flood damage is expected to increase by 25 percent (\$4.3 billion) annually even with modern flood-plain management and regulation. To reduce flood damage, better management of the flood plain, including combining structural measures such as dams and levees, with nonstructural measures such as flood forecasting, advanced-warning evacuation systems, and relocating high-risk properties out of the flood plain, will be used.

One problem is that flood control and water storage are incompatible. Flood control requires nearly empty reservoirs while water storage requires full reservoirs. Water must be kept flowing through dams' hydroelectric turbines to meet power needs.

Erosion and sedimentation: Erosion and the resulting sedimentation are the most pervasive water-related problems in the U.S. The 1975 average cropland soil loss from erosion was nearly 9 tons per acre; in some areas the soil loss exceeded 25 tons per acre. In addition, forest and pasture lands

have soil losses of about 1 ton per acre per year.

Overgrazing of pasture lands reduces vegetative cover, fosters erosion, and decreases long-term productivity. As surface mining expands to support national energy needs, the potential for erosion of the mined lands and acid pollution of run-off water will increase.

Channel banks, beaches, and shorelines can be damaged by the scouring action of flowing waters. Sediment from erosion is carried into streams, suspended in the water, and deposited when streamflow diminishes or when velocities are slowed. The deposits of sediment cause further reduction in velocity and spread the water beyond the streambanks. In reservoirs, the deposits can significantly decrease storage capacity and shorten the life of the reservoir. Sediment is a carrier of pollutants such as phosphates and pesticides, and adversely affects fish and wildlife habitats, damages spawning and nesting areas, impairs fisheries, and clogs navigable channels.

Dredging and disposal of dredged material (dredge and fill): The large volume of sediment deposited each year in navigable stream channels, reservoirs, and harbors requires regular removal and disposal. In order to maintain the navigation network, continued dredging is necessary. Major ports and access channels must be deepened to accommodate modern deep-draft vessels. Demands for harbor and channel maintenance will expand as the efficiency of water-borne commerce is exploited. Dredging and the disposal of dredged materials can disrupt or destroy aquatic life necessary for fish, upset ecological balance basic to wildlife, and adversely affect water quality. Oil and nuclear power-plant siting will add to existing problems of open-water disposal of dredged materials. Loss of wetlands destroys valuable wildlife habitats and nursery and breeding areas for marine fish and shellfish.

Degradation of Bay, Estuary, and Coastal Waters: These areas are extremely

important to the economy because they provide major transportation routes for international commerce, are essential habitats for fish and wildlife resources, and are a source for recreational opportunities for more than 80 percent of the population.

The most significant problem is the discharge of domestic and industrial wastes into these bodies. This is particularly acute in the densely populated New England, Mid-Atlantic, and Great Lakes Regions. Most bays and estuaries have slow flushing rates, and their capacity to handle large amounts of waste is limited. Increased nutrient loading results in eutrophication of the water body, producing algal blooms, noxious weed growth, high oxygen demand, and odor.

Many major bay and estuarine systems may already have reached their capacity to absorb waste.

#### Summary

In the year 2005, water shortages will be more frequent and more severe than those experienced today. Population growth alone will cause at least a doubling of demand for water, especially in areas of low per capita water availability and high population growth. Much of this pressure will be in developing countries where, if improved standards of living are to be realized, water requirements will expand several times. It is these countries that are least able, both financially and technically, to deal with the problem.

As pressures on water resources increase, conflicts among nations with shared water resources are likely to intensify. Particularly likely are interstate and international disputes between upstream and downstream users of river basins over water rights and priorities.

With increasing offstream and instream demands on the Nation's water resources, it must be recognized that competition for water is a fact. Tradeoffs must be made that may result in restrictions on use (and development).

Although competition for water refers primarily to surface water, in most

locations ground- and surface-water supplies are interrelated. They represent a single resource with different characteristics.

#### THE SCENES

The following scenes depict some of the issues likely to confront the Coast Guard in the face of a continued water shortage through the end of the century. The general format presents the circumstances, followed by discussion of the issues to which the Coast Guard must address itself with respect to those circumstances.

#### Scene A: Navigational Difficulties on the Mississippi Due to Periodic Water Shortages

##### CIRCUMSTANCES

In the year 2005, the Mississippi will be strained to capacity with increased shipping because of more demand for grains, coal and minerals. Periodic water shortages resulting from a climatological warming trend will add to the strain.

The inland waterways system will be constrained by continued bottlenecks at locks and dams. Under a defense emergency, the single largest shortfall in lock capacity would occur at the locks on the St. Mary's river between Lakes Superior and Huron. The agriculture and coal industries will be most directly affected (over two-thirds of the unaccommodated use is from these industries), and also the steel industry. The greatest amount of unaccommodated usage will be in the four Mississippi River regions and the Illinois, Ohio, and Great Lakes/Seaway regions.

Unsafe navigation conditions will occur in half of the waterways regions if off-setting actions are not taken. These safety problems involve bridges, waterway structures, channel configurations and congested locations.

Congested locks, increasing real fuel prices and changing traffic mixes

contribute to increasing linehaul costs.

Although the Mississippi has been plagued by periodic problems of low water, it continues to be overloaded with traffic, because of the 2005 acute need to use the most economical method of transport. In the summer of that year, the Coast Guard has been strained to the extreme with heavy traffic trying to make its way in a failing channel. In late summer of 2005, after a season of drought, the Mississippi is littered with beached towboats and barges.

#### ISSUES

The following issues are likely to confront the Coast Guard as a result of the circumstances described above:

1. How to allocate Coast Guard resources in order to accomodate the problems presented in this scene and at the same time meet Coast Guard responsibilities in the ocean environment.

2. The adjudication of the multitudinous conflicts over rights and ownership that arise from the circumstances described--particularly those conflicts arising from investigations of accidents resulting from the change in channel configurations due to water level drops.

3. The problem of making the physical changes necessary to accommodate to a changing geography; this changing geography derives from the lower water levels that for several years have been perceived as temporary, but now are recognized as permanent.

4. The technological problems associated with the physical changes described in #3 above--i.e. how to change bridge structures, canals, breakwaters, etc. to replace those that now sit astride mud flats and banks that were formerly streams canals and waterways.

5. The problem of how to acquire reimbursement for the costs of the rescue operations, salvage operations, repair activities, law enforcement action, navigation



aid maintenance activities, new construction projects, etc. that have arisen incident to the changing water levels in the inland waterways and ports and harbors.

6. How to encourage the respective states to assume responsibility for activities that are, or can easily become, well within their capabilities; how to accomplish this without besmirching the Coast Guard image of ready service to the public.

#### Scene B: Conflicting Uses in a Restricted Ocean Area--Florida Straits

##### CIRCUMSTANCES

In the year 2005, the Straits of Florida are a mass of competing uses, with the Coast Guard tasked with the difficult role of arbiter. Periodic water shortages on the mainland have led to a much increased use of the offshore environment for food and energy production. Population has migrated seaward and in a southerly direction, with concomitant increase in recreational use. Navigation aids, law enforcement and control of illegal traffic, search and rescue, environmental protection, and fisheries management all vie for attention. Clusters of offshore structures have evolved which are practically self-sufficient for energy, fresh water, and food. They are used as oil platforms, OTEC platforms combined with fresh water production, aquaculture and biomass production. Manufacturing of fertilizer has also begun in pilot plants. The Coast Guard has a network of stations on these platform clusters, with tethered surveillance and weather balloons. They act as navigation and communication bases, and ports for Coast Guard ships. These platforms are moveable and/or submersible in case of military need.

The intense need for fresh water has made practical the initial high investment in desalination plants in conjunction with OTEC. The presence of a good energy source makes it attractive to build energy-intensive factories near OTEC. Ammonia, aluminum, chlorine, magnesium and other sea chemicals are

products. Some of these products provide fertilizers, fuels, and feedstocks, or serve as a means to convey electricity to shore. For example, hydrogen or ammonia can be shipped or piped to shore and reconverted to electricity in fuel cells. Water shortages for an increased world population has led to more frequent failure of crops. This has necessitated more intensive fertilizing throughout the world, and fertilizer plants have become the first successful offshore factories. The Coast Guard has the responsibility for safety of the structures, supply ships and pipelines serving these platforms, as well as their placement so as to be the least danger to shipping and environment. The operation of OTEC power plants and ships in the economic zones of coastal states and in international waters will require bilateral and multilateral agreements among nations. Too large a concentration of plants in a given region would degrade the available ocean thermal resource through effluent recirculation. For electricity-to-shore applications, where mooring of a plant will probably be required, sites would be limited to ocean regions with depths between about 1,000 to 2,000 meters.

The vastly increased offshore development generates heavy traffic of its own, in addition to the increased export and import traffic. The Coast Guard has expanded its Vessel Traffic Services (VTS) to include the busiest offshore waterways. This service has reduced accidents, with a saving of lives and property, and a reduction of pollution, as well as facilitating commerce. It includes a vessel movement reporting system on designated VHF/FM channels, traffic lanes and special vessel control areas, and control centers on the offshore facilities. Satellites are used to improve communications and navigational components, and nonvoice data transmission.

#### ISSUES

As a result of the kinds of activities pressed into congested areas of

the marine environment because of the water shortage in the U.S., the Coast Guard will face issues such as the following:

1. The sheer magnitude of the work load in maintaining life preservation and physical security measures in the face of the congestion will demand that the Coast Guard institute a system of user charges in some form; it is inconceivable that appropriated funds can be made available to cover this load. In addition, the manpower and capital intensive activities required to be responsive to these demands will also impose an inordinate load of work.

2. The demand for law enforcement activities is likely to be even more excessive than that for the activities described in #1 above--law enforcement with high density of the usual suppression of drug and other contraband objectives and also heavily laden with requirements for less serious actions like traffic violations, petty crime, theft on the offshore installations themselves, tort claims, etc.

3. The activities of terrorists will also impose an added burden on the Coast Guard, and this will be masked by the many other activities taking place.

4. The use of U.S. naval forces to assist the Coast Guard in its law enforcement role will be proposed and some progress will be made in this regard; however, this may raise the issue of some form of merger between Navy and Coast Guard.

5. The growth of the economic activity in the marine environment will also involve the problem of use management--how to allocate space to the various competing users, governmental and private, who present "irrefutably cogent" claims for specific space allocations. This issue will be particularly troublesome as the growth process accelerates toward the end of the century.

6. A concomitant complication to all of the above will be the increased difficulty in maintaining a clean and unpolluted environment.

## CHAPTER 4: ADVANCED MARINE VEHICLE SCENARIO--FIVE SCENES

This chapter presents detailed scenes depicting Coast Guard applications, circa 2005, of advanced marine vehicles. The chapter is based upon the descriptions of the underlying technologies in Chapter 9 of Volume I.

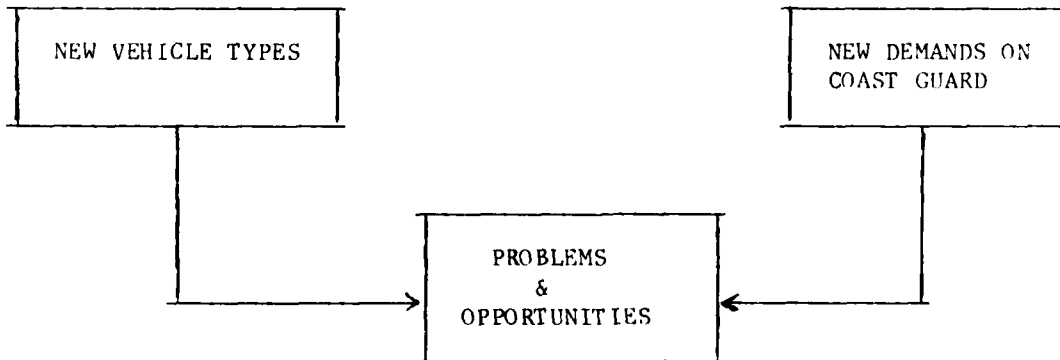
Additional rationale is offered in the beginning of this chapter to place the ship acquisition decision of the Coast Guard into context. This is such an important decision, with such reaching consequences, that it is covered in detail.

### BACKGROUND

#### COAST GUARD ROLES AND MARINE VEHICLE CHARACTERISTICS IN THE YEAR 2005

Figure 4-1 depicts the focus of this scenario. The new demands being placed on the Coast Guard between now and the end of the century coupled with the advancing technology of marine vehicles lead to a set of problems and opportunities heretofore not encountered.

FIGURE 4-1: DRIVING FORCES PRODUCING ADVANCED MARINE VEHICLE



The Coast Guard is a truly multi-mission service. The attribute making the Coast Guard unique in this context is its high performance operational capability. This particular capability applies principally to a limited subset of Coast Guard missions, namely: Law Enforcement (including environmental protection); Search & Rescue; and Military Operations. A number of other missions require ship or aircraft operations, but these three place the greatest demand on the

Coast Guard for high performance operation--i.e. fast decision-making response, least possible time between decision and movement of operational units to a distant scene, and multiple contingencies at the scene--including hostile response from either conflicting parties or from nature itself.

#### EMERGING DEMANDS ON THE COAST GUARD

The choice of a basic vehicle for use in the next decades may be the most important choice the Coast Guard confronts in the immediate future. This decision will commit the Coast Guard to its major operating instrument for well into the next century. It may require imaginative and creative modes of thinking involving significant risk and flouting tradition. Which choice the Coast Guard makes may not be as important as that a choice be made.

This choice will be difficult because it will have to be made in the face of several factors:

- o The U.S.--including the Navy, merchant fleet, and Coast Guard--has maintained a conservative position with respect to advances in marine vehicle technology for several years. For example, the USSR, the UK, and Canada have invested much more heavily in hydrofoil and air cushion craft than has the U.S.
- o The emerging environment demands capabilities in Coast Guard craft that are available only in vehicles considered "unconventional"--the vehicles described in some detail in the previous section--and in many senses unproven in operational environments. Since the investment will have enduring effects, there can be no certainty, at the time of decision, that it is a wise one.
- o Measured in terms of cost/ton or cost/mile or cost/hour of operation these vehicles will not be cost competitive with today's conventional units.
- o The benefits of these new vehicles will be assessable only in terms of their capability to meet operational missions. These benefits are more qualitative than quantitative, and given the multi-mission character of the Coast Guard, they will continue to be incommensurable when assessed in terms of characteristics of different vehicles.

These factors are particularly relevant to the problem/opportunities created by the confluence of a changing environment and advancing marine vehicle tech-

nology.

The following changes in the Coast Guard's operating environment will impact most heavily upon the Coast Guard's basic operating instrument, the combination of vehicles selected to be the principal means of carrying out the Coast Guard's operational missions.

- o Enormously expanded region of responsibility. The 1977 legislation defining the U.S. Fisheries Conservation Zone is likely to be only the leading edge of a change of fundamental nature. It is likely that by the end of the century the Coast Guard will be involved in operations that extend beyond the 200 mile zone and that concern far more than fishing operations. The density and extent of the Coast Guard's responsibility is thus likely to multiply several-fold from its state in the year 1975. It is estimated that the full impact of this change has not yet been appreciated by the cognizant elements of the federal government, but that the events of the next decade may bring this impact into sharp focus.
- o Greatly increased density of commercial and industrial activity. As the economic activities of the U.S. and other AIC's spread seaward, the number of units operating in any given area at a single time will increase throughout the remaining years of the century and into the next. This increase will be in the form of increased traffic, increased numbers of offshore structures, and increased density of pipelines and cables; it will all contribute to increased congestion and probability of incidents to which the Coast Guard will be required to respond.
- o New types of operations and changing balance of contingencies. These changes include such activities as:
  - Operations in support of environmental protection/preservation
  - Fisheries protection and law enforcement
  - Drug and other contraband interdiction
  - Management of sea uses among competing users
  - Increased pressure of illegal migration due to world population growth and worsening food supply
  - Increase in the cognizance of state authorities over regions in the marine environment close to shore--i.e. within the states' zones of territorial hegemony.
  - Increase in commercial activities at greater and greater distances from the U.S. coast lines--with commensurate involvement of the Coast Guard in protection of U.S. interests.
  - Increased international conflict over resources of the seabed at distances from the U.S. coast line not previously experienced--

including acts of terrorism and sabotage of undetermined origin.

- Blurring of the line between international hostility and law violation
- Increased disparity between U.S. Navy weaponry and the instruments of force required by the Coast Guard. Navy weaponry will be increasingly designed to counter the more sophisticated weapons of the U.S.S.R. rather than to counter the types of hostile instruments expected in the usual encounter with a law violator.

A typical operation of a Coast Guard unit consists of several stages that are common to any of the three principal types of operation. Any particular operation may not involve all of these stages, but no operation takes place that does not involve some of them, and many operations do involve virtually all of them: any operation thus can be described in terms of these stages.

- o Intelligence leads the operational commander to a strategic decision as to how to employ his forces to meet the contingency at hand.
- o Surveillance further informs the operational commander as to movements or activities of the object of his operational attention and permits refinement in his strategic decision.
- o Deployment of forces occurs as the result of the commander's decision to monitor or intercept a suspected law violator, persons in trouble, or hostile act.
- o Target detection is the sensor acquisition of the object of attention by a surveillance unit or by a Coast Guard operational unit.
- o Target tracking is the continued sensor monitoring of the movements of the object of attention.
- o Target interception is the movement of surface or air "platforms" of operating forces--people and equipment--to the geographic location of the object of attention.
- o Investigation is the pay-off stage and consists of one or more of the following actions at the scene:
  - Board with men and equipment to inspect, cite, or seize.
  - Investigate by remote means using visual and instrumental techniques, then cite and/or seize.
  - Disengage
- o Seize/defeat is the final action against a hostile or uncooperative person or group, and includes all the possible anti-social action which the Coast Guard is empowered by law to take, including actual application

of force and taking a craft under tow.

The stage of this sequence that is most sensitive to the basic mobility characteristics of the vehicle being employed is Target Interception. The actual effectiveness of the Coast Guard in its mission, once intercept has occurred, is not highly dependent upon these mobility characteristics. In other words, the requisite mobility capabilities of a vehicle are somewhat independent of whether its mission is law enforcement, search and rescue, or military. Thus a decision to invest in a particular advanced marine vehicle will rest more on geographical considerations than on which of the three principal missions it is to be employed in. The distance a vehicle must traverse, and the conditions to be encountered at its objective--e.g. open sea in bad weather or heavy surf along a beach--may be independent of the nature of the mission.

At a secondary level the function to be performed will have an effect. For example, the complex of weapons carried may well represent a trade-off to vehicle speed or size. But for the other functions--search and rescue and law enforcement--such a trade-off is less likely to be required, since the actual physical equipment involved is an order of magnitude lighter and smaller than an integrated system of weapons.

Another consideration is that with sophisticated surveillance and C<sup>3</sup> systems the time involved in a vehicle's searching, including the many false starts and stops that inevitably accompany all searches, will be reduced. Thus endurance requirements are reduced. The more directly a vessel or aircraft can proceed to its intercept point, without search or diversion, the less endurance the vehicle will be required to have in order to be mission-capable.

#### Impact of environmental changes on operational stages

The effect of the forecast environmental change on the stages of a typical operation are summarized as follows:



- o The geographic expansion of Coast Guard cognizance impacts heavily on the need for intelligence and surveillance. Even with the most advanced vessels and aircraft with which to intercept, the vast distances now required to be watched prohibit coverage by any means except the most sophisticated surveillance and intelligence techniques. In other words, none of the advanced marine vehicles under consideration have inherently sufficient capability to overcome the geographic problem; this will have to be accommodated through advances in intelligence and surveillance.
- o The new environmental conditions require that forces either be predeployed expansively to be in proximity to anticipated problems, or that the forces have the capability to traverse quickly the large distances involved.
- o If operations at distances of several hundred miles at sea are involved, it may not be feasible to deploy Coast Guard units effectively; but the faster these units can move, the more likely is effective deployment.
- o The effectiveness of target detection and tracking is not dependent upon the mobility characteristics of the vessel or aircraft, except to the point that the vehicle must be capable of carrying the necessary instrumentation/equipment.
- o The key stage most affected by the mobility characteristics of the vehicle is that of Interception. Here again the mission-effectiveness is not determined by the nature of the operation--search & rescue, military, or law enforcement--but more by the distance to be traversed and the conditions at the end of that distance--i.e. surf, heavy seas in the open ocean, etc. But the vast increase in distances to be covered under the new environment makes an enormous difference in the degree to which craft of various types are capable of performing their missions. It is clear that the high speed hydrofoil or air cushion vehicle is a tremendous improvement over conventional forces for open ocean missions, and that the air cushion vehicle is a vast improvement for missions involving rescue operations along beaches and coast lines where surf conditions are troublesome.
- o The Investigation stage is also susceptible to success or failure depending upon the characteristics of the vehicle. Referring to the preceding paragraph, the capability to operate just above a foundering small craft in a surf is vital to the success of many search and rescue missions, law enforcement missions close to shore, or military missions such as the river delta operations in Vietnam. Similarly, the capability to take personnel from a foundering tanker in a heavy seaway is crucial to success in search and rescue in the open sea; the capability to board and investigate in the open ocean in rough seas is also crucial. This interaction between craft in heavy seas is immeasurably aided by the advent of the intership robot, with capability to board and maneuver on board, using its television and radio link back to its controller, as though the controller himself were doing the maneuvering.

#### Impact of environmental changes on force composition

In a multi-mission environment the exact mix of capabilities required for

optimum operational capability is not susceptible to precise analysis any more than is the exact nature of "the most effective vehicle". However, certain things can be said about such a mix.

- o Number of units It is clear that the sheer increase in geography of Coast Guard responsibility will demand an increase in the number of operating units. However, the amount of this increase may be considerably less than proportionate to the increased geographical coverage if the mix is suitably designed with high speed vehicles, and with vehicles capable of operating in the diverse conditions to be encountered.
- o Proportion of platform types. In order to respond in minimum time to requirements at some distance, the number of high speed craft will have to be increased. If this increase is at the expense of endurance, then the intelligence and surveillance support must accomodate the short-fall. The implication is that as the U.S. economic activity moves seaward, and as the states relax their demands for Coast Guard service to perform functions amenable to state action, the mix of craft in the Coast Guard will be required to shift away from the boats and patrol craft density that now exists and toward a higher concentration of high performance vehicles.
- o Platforms: Seaborne/airborne mix. The combination of required higher speeds and longer endurance for distant operations will be especially important for those platforms from which boarding takes place. At least through the end of the century these platforms will be restricted almost completely to surface-borne craft, although against no opposition some uses of helo drops may be feasible.
- o Logistic support capability. As the operational center of gravity of Coast Guard units moves seaward the logistic support of these units will assume larger dimensions. Conceivably sufficiently advanced intelligence and surveillance capabilities, coupled with extremely high speed vehicles with sufficient endurance to strike out from continental bases, perform a mission at several hundred miles distance, and return to base without refueling could obviate the logistic problem. But short of that combination, some form of platform base (see Vol I, Ch 10, page 3), or underway replenishment capability may be required. The advanced marine vehicles under consideration to this point can reach out to great distances in relatively short times, but cannot stay on station for long periods, or reconnoitre on station to any extent.

#### RELATIONSHIP: ADVANCED MARINE VEHICLE CANDIDATES TO CG ROLES

The charts which follow in Figures 4-2 and 4-3 depict an approximate relationship between the advanced marine vehicle types under discussion in the previous portions of this report and the missions and roles of the Coast Guard. No attempt is made to evaluate in any way which of the vehicles is "best". It

is not possible to include all the requirements for all the missions, and in some cases one requirement overrides all others--e.g., the ability to break ice on ice missions. Speed is another overriding requirement for some missions. Because of different requirements for various missions, no one vehicle will be appropriate for all the Coast Guard missions, and there is no significance to adding or averaging the columns. Some mix appears to be required which includes the capability to operate at large distances from U.S. shores at high speed and the capability to operate over beaches and the coast line. This capability resides in two of the vehicles considered--the air cushion vehicle and the hydrofoil--and we consider that some combination of these two types would serve well the Coast Guard needs through the end of this century and well into the next.

A key feature of the next generation of craft is that for the highest priority missions--ELT, SAR, & MP--the highest possible speed at the longest possible range will be required for the execution of any of the tasks associated with the mission, except patrolling and surveillance. For patrolling and surveillance, endurance and maximum economy at low speeds is the most important characteristic. With satellite surveillance, with an efficient intelligence net, and with a capability to operate Coast Guard craft from platform bases at some distance from shore, the need for patrol/surveillance functions can be reduced. So the characteristics required can be better focussed into those required for the actual completion of an interception/interdiction mission, uncompromised by the need for high endurance at low speeds.

Figure 4-2 portrays the relationship between priorities required in ships and equipment capabilities (column headings) and Coast Guard operational missions (the row headings) in terms of a rough ordinal scale from 1 (highest priority) to 5 (lowest).

Figure 4-3 depicts the relationship between capabilities (column headings) and Coast Guard missions. The cells indicate the vehicle types with the capabilities listed across the top, for the Coast Guard missions listed at the row head. Thus this chart shows the type of vehicle judged to be generally most suitable for each mission.

The charts in these figures are not meant to be absolute "solutions"; the weights are highly judgmental and therefore subject to change by whoever is making a judgment. What is presented is a systematic way of thinking about the problem.

FIGURE 4-2: PRIORITIES IN SHIPS AND EQUIPMENT TECHNOLOGY

	Speed	Energy Conservation	Man-ning (#s)	Pay Load	Landing (Air-craft)	Advanced Computer Ability	Stable Sea-keeping	Main-tainability°	Endur-ance	Range	Amphib-ious	Can Break Ice
Emergency assistance and rescue (SAR)	1	4	2*	3*	1	1	1	2	1	1*	1	5
Surveillance	5	3†	4	5	1	1	3	2	1	1	5	5
Interdiction	1	4	1	5	1	1	3	2	4	3	1	5
Law Enforcement (ELT) (NO/MP)	1	3†	2*	4	1	1	3	2	3*	1*	1	5
Military Preparedness	1	3	?	4	1	1	3	2	2	1	1	5
Short Range Aids to Navigation (AN)	5	1	3	2	5	3	3	2	1	3	5	5
Radionavigation Aids (RA)	5	1	3	2	5	1	3	2	1	2	5	5
Ice Operations	3	3	2	3	3	3	3	2	1	1	2	1
Environmental Protect.	3	3	2	1	3	2	2	2	3	2	3	5
Weather Prediction	5	1	4	5	5	1	3	2	1	2	5	5

1 - 5: Order of importance (1 = most; 5 = least)

\* Could be broken down to components (search, rescue, man & tow)

† Need fuel economy when patrolling

° Supportability/Maintainability - logistic and shore support requirements

FIGURE 4-3: VEHICLES WITH BEST MATCH TO MISSION NEEDS

Coast Guard Mission	Speed	Energy Conservation	Man-ning (#s)	Pay Load	Landing (Air-craft)	Stable Sea-keeping	Endur-ance	Range	Area of Coverage	Amphib-ious	Can Break Ice	Frequency of				
Emergency assistance and rescue (SAR)	d				ab	abc	ade	d		b		3	2	1	1	1
Surveillance								e								2
Interdiction	d		bc		ab					b		1	3	1	1	
Law Enforcement (ELT)	d				ab			d		b		1	2			2
(MO/MP)																
Military Preparedness	d		bc		ab			d		b		1	3	1	2	
Ice Operations							a	d		b	b	1	2		1	
Environmental Control				ad								1				1

\*a. = SWATH, b. = Air Cushion, c. = FOIL, d. = Wing/Ground, e. = LTA

©Importance reduced with improved surveillance

### THE SCENES: GENERAL CONSIDERATIONS

Each of the three operating functions of the Coast Guard--ELF (including environmental protection), search and rescue, and military operations--can be regarded as having three stages in common: patrolling or waiting for action to develop; the fast move to intercept a target; and interaction with the target at interception--use of weapons in the case of military operations, and direct physical contact of Coast Guard personnel with the personnel or material of the target in the other two cases (boarding, taking personnel off an endangered vessel, seizing, etc.)

The value of endurance will diminish and the value of speed will increase as we move into the next century. The characteristics of the vehicle are important determinants of the degree to which each of these three functions can be carried out successfully, particularly the second--the rapid movement to intercept. If the forecast is correct that technological advances are likely to result in acquisition of sophisticated satellite-aided intelligence and surveillance systems, and that the use of offshore platforms will be feasible as operating bases for Coast Guard surface and aircraft, then the need for Coast Guard vessels with capability to patrol or remain on station in a waiting mode for long periods will be reduced. Then the characteristics can be optimized for the second function (rapid movement to intercept) and the third (interaction with the target). On the other hand, if advantage is not taken of these advances in intelligence and surveillance systems, the characteristics of new Coast Guard craft will be compromised by adherence to more traditional values placed on endurance.

Given the foregoing, the best hedge against having to revert to the patrol function will be the hydrofoil, with its capability to operate like a more conventional vessel except when foiled at high speeds.

The scenes which follow rest on this point of view.

The purpose of these scenes is not to demonstrate the comparative advantages of one type craft over another, but to show how any or all might fit into the context of Coast Guard missions, with the strengths of each type being exploited in the circumstances of the respective scenes.

The following summary indicates the principal thrusts of the scene-building:

<u>Situation</u>	<u>Vehicle in Use</u>	<u>Mission</u>
SCENE A: Rescue operation along coast, with weather interference	ACV (Air Cushion Vehicle) & LTA (Lighter than Air)	SAR
SCENE B: Drug interdiction operation at sea beyond the 200 mile limit.	Hydrofoil, ACV	ELT
SCENE C: Terrorist action on oil rig on OCS.	Hydrofoil & ACV jointly	MILITARY
SCENE D: Large drug and alien smuggling fleet moving from South America up through the Caribbean toward many coastal points of entry in the Gulf of Mexico and along the east coast of the U.S.	Task force of ACVs, hydrofoils, LTAs, SWATH, RPVs (Remotely Piloted Vehicles)	ELT
SCENE E: Hostages in man-made-island oil platforms off north slope of Alaska in weather conditions of the arctic winter.	ACVs, Ram-wing	MIL/ELT IN COMBINATION

SCENE A: Rescue operation along coast with weather interference

1. Coast Guard station in Long Beach, California, alerted by command net that a recreation craft has run aground in heavy surf off Point Arguello. No Coast Guard stations between Long Beach and Point Arguello.
2. Command net indicates position accurately (within 0.5 mile) on the coast, 120 miles from the Coast Guard station.
3. ACV dispatched to scene in heavy fog and with weather reports indicating



high winds due.

4. ACV crew consists of officer in charge (OIC) and five crewmen and is equipped with C<sup>3</sup> equipment to permit full communications with Coast Guard station and thorough update on a continuing basis with information from the C<sup>3</sup> net on the foundering recreational craft.
5. ACV has video presentation of large area showing location of target, reducible to small-area large-scale presentation as the vehicle nears the target.
6. Time to target from initial information to ACV arrival on scene: 2.5 hours.
7. IR TV available to the ACV OIC, permitting him to see through the fog as he approaches the target boat.
8. ACV finds boat in heavy surf and in imminent danger of breaking up. Bull horns permit one-way communications with personnel on the craft, but no means exist for personnel on board to communicate with the ACV.
9. ACV hovers close aboard craft, with hover position held firm by automatic control, using geographical objects as base, backed up by gyro-inertial system.
10. ACV swings out rescue boom with which to lift personnel free from foundering craft. Heavy duty line, controlled from deck of ACV, reeved from deck along boom and down to an automated bosun's chair (a robot) suspended at boom extremity.
11. Communications with personnel on boat established through robot. TV cameras permit detailed observation of circumstances on boat from ACV without hazard to Coast Guard personnel. Two injured personnel on board.
12. Weather continues to worsen, and weather reports indicate worse to come.
13. ACV keeps Coast Guard station in Long Beach advised of progress, both through automatic transmission of TV and radar information, and through voice radio.
14. Robot easily accomodates the two injured personnel, one at a time, despite the weather--and they are removed safely. Robot returns for repeat trips

until remainder of personnel are safely removed.

15. ACV OIC learns that foundering craft has extremely heavy, expensive, and irreplaceable research equipment on board in use for contracted R&D projects with the U.S. Department of Interior. OIC advises Coast Guard commander to this effect. Transmission monitored by C<sup>3</sup> nets and within minutes DOI requests action to remove equipment from foundering craft if at all possible. Certifies user charges authorized to reimburse Coast Guard for operational expenses.

16. Local CG commander requests District Commander to send "all-weather" heavy-lift LTA to scene for removal of precious equipment. Weather hazard continues to exist. District Commander concurs and orders LTA vehicle to deploy.

17. ACV in immediate communications with LTA and passes oral information by radio to supplement information available to LTA on C<sup>3</sup> nets.

18. ACV en route to Long Beach with rescued personnel, paramedics administering emergency medical treatment under radio guidance of physicians at Long Beach.

19. Foundering craft determined to be unsalvageable and reported as such. Coast Guard station determines that in daylight when weather clears, a crew will be dispatched to remove the wreckage, charging the owners of the craft for the service--such charge to be invariably passed on to insurance company of owner, due to mandatory holding of insurance by all boat owners/operators.

20. ACV returns personnel to Long Beach.

21. ACV skipper reviews recording of incident as play-back from local C<sup>3</sup> net components; edits and adds information as necessary and submits report of incident.

22. Incident closed.

SCENE B: Drug interdiction operation at sea beyond the 200 mile limit.

1. National C<sup>3</sup> net advises Coast Guard District headquarters in Portsmouth that Colombian drug-running mother-ship (MS) is believed to be scheduled to

rendezvous with small craft for transfer and infiltration into the U.S. about 200 miles off the east coast of the U.S.

2. District Commander alerts his forces, consisting of 2 armed hydrofoil vehicles, and places them in readiness condition as "Hydrofoil Task Group" (H TG) to respond on short notice. Each craft has transoceanic capability without refueling, which means about 3 days endurance at high speed, and about 10 days endurance at economical speeds. Because of the capability of his forces to respond quickly to distant requirements, these forces are not highly dispersed, but are located in a reasonably concentrated area near the District Commander's headquarters. District Commander moves to his command/operations center to observe outputs of C<sup>3</sup> nets at national and regional levels concerning the suspected rendezvous.

3. Satellite surveillance indicates contact with suspected MS; images appear on screens of operations centers of H TG ships. MS located to the east of Miami, about 600 miles, expected to rendezvous with delivery craft about 300 miles east of the entrance to Chesapeake Bay in approximately 30 hours.

4. MS identification confirmed by intelligence and this information is passed to H TG through the C<sup>3</sup> net. Rendezvous estimates updated.

5. Probable track of MS established by reliable surveillance from satellite.

6. Coast Guard commander decides to reinforce H TG with large ACV based on platform on OCS about 200 miles due east of Cape Charles. ACV has heavy load capability and is more powerfully armed than are the two ships in the H TG. ACV is ordered to be prepared to assist the H TG if required in the face of armed opposition from the MS and delivery craft.

7. Intelligence confirms expected rendezvous point for MS with small craft, believed to constitute the drug-running group's final effort to land contraband

in the U.S. Small craft not identified on screens of C<sup>3</sup>, but watch set to observe possible movements of such craft up and down the coast.

8. Estimated departure time of H TG set at X hrs; tactical objective is to intercept MS at about time delivery craft are offloading contraband. Effort will be made to avoid suspicions of MS or delivery craft through premature revelation of high speed H TG approaching. Arrival of ACV and H TG planned to coincide with first revelation to the MS's radar, or through reports from delivery craft.

9. State Department clearance obtained for intercept and treaty enforcement action using force if necessary; Colombian government in accord.

10. Surveillance system identifies numbers of possible small craft in the general coastal traffic patterns, but none are confirmed by communications or other electronic intelligence means.

11. Local CG Commander receives request for assistance from recreation boat about 10 miles off Cape Charles. After concurrence by District Commander, one of H TG ships sent; high speed permits completion of short range SAR mission and refuel with no interruption to drug-interception operation.

12. H TG ordered to intercept MS at best speed. ACV still in state of readiness standing by at platform. Several craft under surveillance as suspected delivery craft, all moving slowly toward estimated rendezvous point. Identified on CRTs of H TG ships.

13. After about 3 hours transit, District Commander's intelligence indicates doubt as to identity of MS; another potential mother-ship has emerged from surveillance about 200 miles south of MS present position. Not clear whether second is not related, a second MS, or whether possibly have been on wrong ship entirely to this point. H TG ordered to slow and conserve fuel.

14. Second ship determined to be not involved. Interception by H TG ordered

resumed after about 3 hours standing by.

15. Delivery craft identified with 90% confidence by intelligence and transmitted on C<sup>3</sup> nets to H TG; H TG ships receive this information on CRTs, though not yet on own radar scopes.

15. Identity of MS confirmed by intelligence and surveillance. ACV ordered to intercept simultaneously with H TG.

16. Radar scopes of H TG and ACV pick up MS; H TG and ACV assume coordinated intercept courses, H TG at maximum speed--100 knots. Simultaneously MS picks up speed and begins to move directly away from H TG. Three identified delivery craft also picked up on H TG scopes as they also increase speed and become more visible by radar.

17. Electronic/communications intelligence (called "ELINT" and "COMINT", respectively) confirm identification of delivery craft and that they intend to use force against H TG. District Commander orders H TG and ACV to use force in selfdefense and to enforce law/treaties.

18. At interception of MS, H TG orders MS to halt for investigation. MS refuses and delivery craft converge on H TG. H TG speed advantage plus ACV fire power place delivery craft in jeopardy. Delivery craft retire out of weapons range. MS halts and H TG first makes robot investigation on board, then sends boarding party to check cargo. Drugs discovered on board; ship and cargo seized. Delivery craft approached by ACV, but immediately retire from scene. Follow-up of delivery craft not authorized by District Commander on the grounds that no evidence would be likely to be found to justify search/seizure. However, electronic, magnetic and acoustic signatures thoroughly recorded and identified with these craft.

19. H TG returns to port, ACV returns to platform base, mission completed.

SCENE C: Terrorist action on oil rig on OCS off New England.

1. District Commander informed by oil company owner of offshore rig that his rig is being taken over by group of unknown but hostile persons, and that the manager of the rig is a hostage. He has been informed that the manager will be killed and the rig blown out if a group of Latin Americans, held in U.S. prison because of illegal immigration coupled with criminal records, are not released.
2. District Commander immediately consults with Commandant and local authorities. Those in turn acquire White House, State Department, Defense Department and state government attention.
3. District Commander orders task group of 1 hydrofoil and 1 ACV--labeled the Hydrofoil/Air Cushion Task Group (H/AC TG)--to highest readiness condition, and to prepare to join forces with U.S. Navy ships in operation against the terrorists. ACV has capability to launch and recover aircraft, and to operate large RPV's.
4. H/AC TG commander decides to establish blockade around rig and "wait it out". High speed of TG plus capability to maintain an air operation around the clock renders small number of craft adequate to make the blockade completely effective. U.S. Navy ships not needed, but placed on stand-by status.
5. Attempt by others from terrorist group to break blockade fails because of armament and speed of H/AC TG.
6. After 7 days of activity, during which the H/AC TG has completely cut off the rig from outside contact, and has clues that the terrorists are close to being starved into submission, the terrorists call for discussions. Discussions appear to be proceeding satisfactorily, but a general feeling of suspicion arises among Coast Guard officers that a "trick" is underway. Decision is made to inspect entire structure of platform below the water line in order to ascertain if explosives have been planted for later activation.

7. Remotely piloted vehicles (RPVs) with submerged capability sent by ACV to explore entire submerged structure of rig. Preprogrammed search and detection action carries the RPV's through a sequence of moves that apprehend the terrorists in the very acts that were suspected. Explosive plants are neutralized and the terrorist are then taken hostage by the Coast Guard.
8. Terrorists agree to terms and are incarcerated by civil authorities, with the operation of the rig returning to normal.

SCENE D: Large drug and alien smuggling fleet moving from South America up through the Caribbean toward coastal points of entry in the Gulf of Mexico and along the east coast of the U.S.

1. Intelligence reveals to the Commandant that a large drug/alien smuggling ring is in operation with an immediate objective of moving a fleet of drug/alien carrying craft into Puerto Rico, the Virgin Islands, the Gulf of Mexico and to several places along the East Coast of the U.S. from a variety of locations, mostly from South America, but also from Africa, the Middle East and the Far East. The means of access to U.S. territory is along isolated portions of coast line wherever these can be approached.
2. District Commanders in the Gulf and along the east coast of the U.S. are apprised and alert their forces.
3. The U.S. national intelligence and surveillance nets are also alerted, and begin to examine all traffic in the Caribbean and the southern portions of the Atlantic for evidence of being related to this movement. Highly sophisticated intelligence methods are brought into action, including satellite tracking, ELINT, COMINT, and human-collected intelligence (HUMINT).
4. Intelligence warns that the most likely approach is from the north coast of South America and from the South Atlantic off Brazil, but an approach from the eastern Atlantic is also reasonably likely.
5. Coast Guard forces are alerted, but because of their high speed capability,

they are not required to be prepositioned in order to be ready for any intended action. Consequently they continue their normal operations.

6. Surveillance discovers the initial stages of movement from the suspected runners off the east coast of South America, and all Coast Guard forces are informed. A task force of ACV, hydrofoil, SWATH, LTA, V/STOL, and RPVs is developed, and units are assigned and notified of intended action.

7. The surveillance system identifies units of the suspected runners south of Jamaica; two Coast Guard LTA are sent to supplement the national surveillance nets from a fairly long stand-off distance. The LTA report craft showing the electronic signatures of the suspects scattered over many hundreds of square miles in the region just east of the Lesser Antilles, all on a generally north-westerly course, headed toward the objectives indicated previously by intelligence. Because of their long airborne endurance, the LTA maintain distant patrol in the general vicinity of the craft, but remain out of visual contact with them.

8. After about the third day of observation, the identity of the runners is fairly well established, and a running account of their progress is provided on a continuing basis to the Coast Guard commanders likely to be involved. The runners are well scattered and from a visual point of view extremely well camouflaged; the only clues of identity are electronic and acoustic signatures--acoustic signatures picked up by the Navy's underwater passive arrays.

9. As the runners from the southeastern Atlantic approach the Lesser Antilles they are joined by additional craft from the north coast of South America--many of them from Venezuela. Apparently the tactical objective of the runners is to saturate U.S. counteraction capabilities with large numbers of craft; some losses are apparently considered a reasonable price to pay for the amount of drugs that get through. The tactical objective also appears to be to hide



the craft in a mass of traffic so that the fact of the intrusion will not even be discovered until very late--too late to counter it with U.S. law enforcement capabilities.

10. Coast Guard units in Puerto Rico and the Virgin Islands are formed into a task unit--the Caribbean Task Unit (CTU)--and sent to intercept those units of the runners approaching these respective islands. These forces consist of one SWATH with aircraft launching and recovery capability--including V/STOL and RPVs as well as conventional aircraft--and one ACV with the capability to maneuver over beaches and marshes along coast lines. U.S. intelligence estimates indicate that the major objective of the runners is neither Puerto Rico nor the Virgin Islands, but the coast line of the U.S. where the market is both larger and richer. Therefore the Coast Guard forces allocated to the islands are relatively light.

11. The CTU--with the assistance of the C<sup>3</sup> nets, the intelligence provided, and the surveillance system--maintains a track on the location and movements of the runners approaching the islands.

12. One group of runners appears to break off from the group and head for the vicinity of San Juan. The SWATH carrier is sent to intercept this group, and using manned aircraft and helos stops, searches, and seizes many of them. This action appears to deter their further entrance into the coastal waters of Puerto Rico. Because of the high speed capability of the ACVs, and the air carrying capability of the SWATH, the CTU is able to block most of the intrusion--enough to support an assessment that the runners' costs exceeded their benefits.

12. As the runners approach the western end of the Bahamas the Coast Guard District commander vectors his longer range craft and his LTA, followed by a second aircraft-carrying SWATH, to intercept them. State Department clearance

is granted to use force if necessary on specifically identified craft.

13. The runners' dispersion has increased as they encounter opposition, and their identity begins to become fuzzy. However, U.S. surveillance technology is able to maintain reasonably accurate identification of most of them, despite the increased dispersion and diminution of resolution to land the drugs and aliens.

14. At this point the Coast Guard commanders along the coast and in the Gulf deploy their ACVs along the portions of the coast most likely to offer concealment to the incoming runners. The ACVs constitute the last line of defense of the Coast Guard to the intrusion, during which it must be picked up and transferred to the cognizance of land-based police units. The capability of the ACVs to operate along and over the coasts and beaches at high speeds without being dependent on a harbor of any kind as a base is particularly valuable in this phase of the operation. In order to land their contraband the runners must arrange in advance for an appropriate receptor on the land; with the ubiquitous threat of the ACVs, this has become extremely difficult for the smugglers.

15. The last phase of the operation concludes with the Coast Guard ACVs encountering, stopping, and confiscating large amounts of drugs and illegal immigrants as they attempt to intrude along and over the Mississippi delta.

SCENE E: Hostages in man-made-island oil platforms off north slope of Alaska in weather conditions of the arctic winter.

1. Intelligence informs the Coast Guard commander on the North Slope that for several days an oil drilling operation on a man-made island off Cape Halkett, Alaska, has been subject to intermittent harassment from an unknown source. This harassment has taken the form of mysterious explosions of a minor nature causing little damage, but unnerving the crews. Weather is extremely adverse, about the worst that it is deemed feasible to operate the rig in.

Access to the rig is only over ice.

1. The Coast Guard commander at Point Barrow directs an ACV to investigate.

This craft is capable of making the ice-bound transit of 120 miles to Cape Hallett in slightly more than two hours.

2. In order to be prepared for severe trouble from the unknown source of harassment, the Coast Guard commander requests that the District commander alert a ram-wing aircraft to be prepared to assist.

3. As the ACV approaches the rig, information from its crew becomes increasingly confusing, and the ACV OIC concludes that the crew may be in serious trouble from an unknown source.

4. In the meantime the Coast Guard District Commander, who has been monitoring the C<sup>3</sup> nets and is therefore completely up to date on the situation, requests military assistance from the Commandant, who in turn starts action at Defense to acquire assistance. The Joint Chiefs decide to assign a marine unit to assist.

5. The District Commander orders his ram-wing to proceed to the scene with a Marine "Commando" group on board ready for hostile action.

6. ACV arrives at oil rig and finds that terrorists have been partially successful in creating damage, but have not been successful in taking hostages. ACV OIC considers situation beyond his capability and decides to wait for the ram-wing and its Commando crew.

7. Ram-wing lands on the ice-covered man-made island in the midst of heavy winds and darkness. By the time the Commando group has reached the rig, its crew have been attacked and many of them wounded by the terrorists, who have also suffered heavy casualties.

8. At this point both sides have been decimated to the point of being unable to continue conflict, and the operation has devolved into a mission to rescue injured personnel--personnel from the crew of the rig, and personnel

from the terrorist group who infiltrated the rig but are no longer capable of antisocial action.

8. Ram-wing aircraft removes injured personnel from rig and returns them to Point Barrow, repair crews restore rig to operation, and the Coast Guard institutes a thorough investigation into the sources of the terrorist activities in order to prevent a recurrence.

## APPENDIX: VOLUME II

### LIST OF REFERENCES/BIBLIOGRAPHY AND PERSONS INTERVIEWED

This list of references/bibliography is presented in sections corresponding to the principal topics covered in the report. Officials interviewed are listed on page A-22.

1. The Macro Environment
2. Science and Technology
3. The Marine Environment
4. Coast Guard
5. Relevant Technologies
  - a. Command and Control
  - b. The Environment
  - c. Water Shortage
  - d. Advanced Marine Vehicle

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#### LISTING OF OFFICIALS INTERVIEWED

The Contracting Officer's Technical Representative, Dr. Harry N. Hantzes, and his assistant, Ensign T. W. Carter, contributed advice and information to the entire study process. In addition, the following Coast Guard officials, listed alphabetically, granted generous interview time which proved to be most helpful.

Commander W. W. Becker

Lieutenant Commander D. R. Freezer

Captain T. C. Lutton

Mr. J. T. Milton

Mr. L. J. Nivert

Commander J. F. Roeber

Commander B. H. Romine

Captain H. M. Veillette

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